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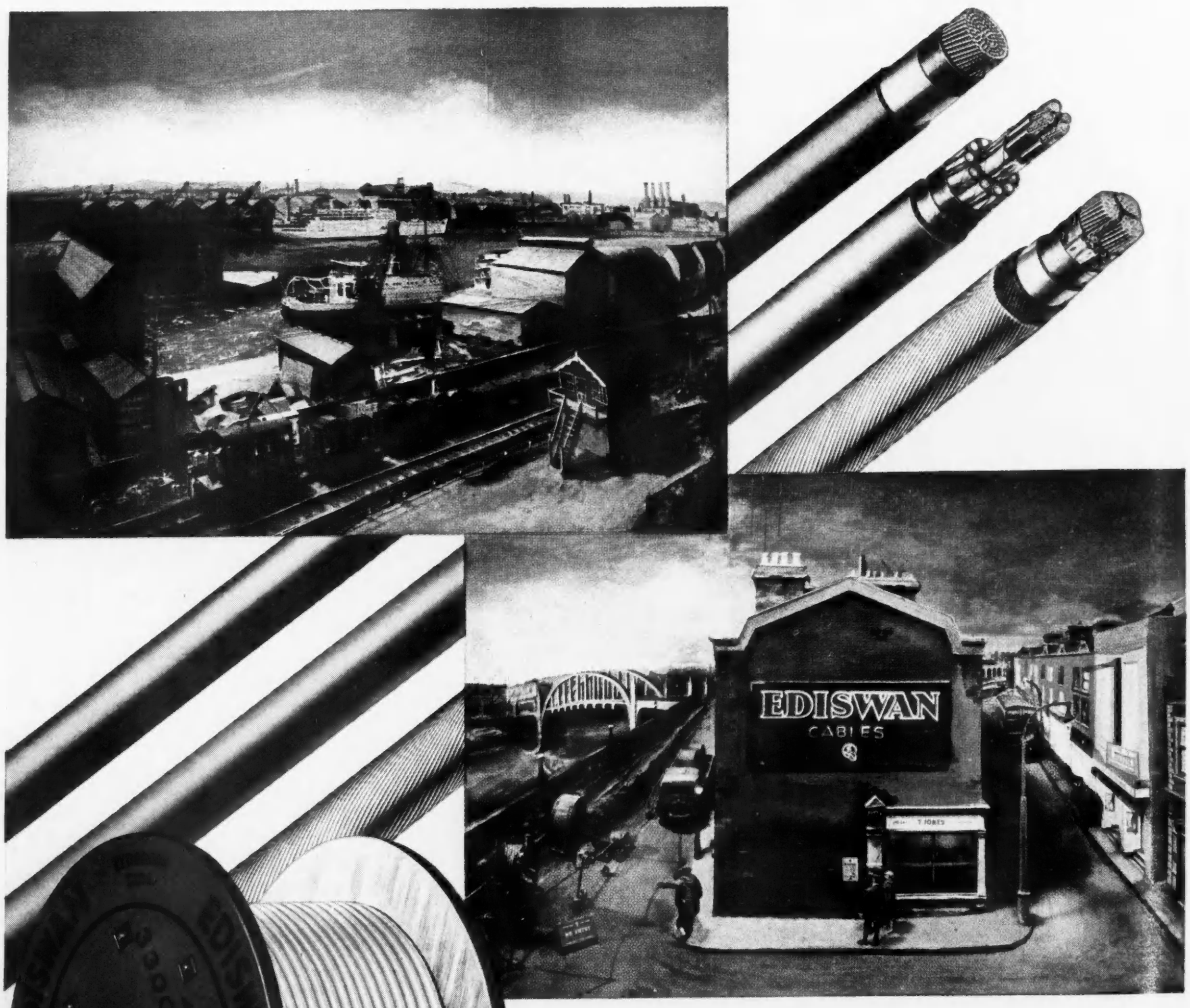

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ELECTRICAL REVIEW

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15 APRIL 1955

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ELECTRICAL REVIEW

15 April 1955 Vol. 156 No. 15 Established 1872

The Exhibition Problem

By deciding to hold the London Section of the British Industries Fair in two parts at different times of the year, British Industries Fair, Ltd., is reverting partially to former practice. When the change from February to May was made before the war there were many exhibitors who did not agree with it, particularly those engaged in " seasonal " trades who wanted the display to be as early in the year as possible. Among them were a number of electrical manufacturers, principally those concerned with domestic appliances and other consumer goods. The main argument in favour of May was that weather conditions then were more attractive to overseas visitors than in February.

So far as capital goods are concerned the season of the year is immaterial and under the new arrangements the Birmingham Section, which is largely of a " heavy " character, will still be held in the spring. The same applies to the Olympia display in London which will accommodate the lighter, non-seasonal, industries.

It is noted that these changes may necessitate some adjustment between the industries showing in Birmingham and London. But the altered arrangements still leave the electrical exhibitors' problem unsettled. The rapid attrition of the Electrical Section at Castle Bromwich has shown that there is much dissatisfaction with the present system, and Birmingham's loss has not resulted in much gain by the London Section. Yet there is a feeling that the electrical manufacturers' allegiance to the Fair could be regained by moving the Electrical Section from Birmingham to London even if it were to be only in alternate years. A referendum was recently taken among electrical manufacturers in order to secure their views on the subject. So far the result has not been announced but it is hinted that the move is favoured by a good many potential exhibitors.

Another section of the industry would prefer a periodical electrical exhibition either quite separate from the Fair or run in conjunction with it, or at least at the same time. Others would be content to take space in some of the many specialist industrial exhibitions, in all of which electricity is of great importance.

Our own opinion has hitherto been that there must be an Electrical Section in the B.I.F.; otherwise the Fair would be seriously unrepresentative of British industry. At the same time we realize that those who have to meet the substantial cost of exhibits, wherever they may be set up, must have the final word. It seems difficult, if not impossible, to reach unanimity but we hope that by discussion with the organizers of the Fair and other exhibitions the electrical manufacturers will eventually arrive at some arrangement to ensure that the ability and achievements of the industry are effectively presented nationally and internationally. A lead from the B.E.A.M.A. is overdue.

ITALY-SICILY TRANSMISSION

In this issue we publish, for the second time within the month, an account of a major example of transmission line engineering. We make no apology for this. Transmission to-day is a subject of immense importance: the siting of our large new power stations, including nuclear stations, is rendered infinitely more flexible as a result of advances in the high voltage transmission of large blocks of power; and lest it be thought that this represents only a fraction of the electrical industry, note should be taken of the figure of £13,500,000 as the cost of transmission works authorized by the Central Electricity Authority during the year 1953-54. Overseas, British consulting engineers and overhead line contractors are likely to meet many transmission line problems as sources of bulk hydro-electric power remote from populations are deemed capable of economic development. It is indeed frequently because of the constant advance in transmission technique that such schemes, unthinkable twenty years ago, have become economic to-day. We feel sure readers will be interested in the way Italian engineers have solved the challenge of the power link across the Strait of Messina.

HIGH-FREQUENCY MOTORS

A feature of the experimental machinery employed in the U.S.S. *Timmerman* is the use of 400 c/s motors for nearly all auxiliary drives. This is part of an overall scheme to introduce 100,000 s.h.p. of less weight and dimensions than those required for the 60,000 s.h.p. in previous destroyers of the same displacement and hull form. From particulars given by Commander D. G. Phillips, U.S.N., to the Institute of Marine Engineers, the aggregate weight of electrical plant is only 45 per cent of the normal. The weights of the individual high-frequency 950 V three-phase motors range from 25 lb for 3 h.p. to 215 lb for 60 h.p. compared with the 115 lb and 750 lb of the 60 c/s 450 V standard machines. Corresponding dimensions go from $7\frac{3}{8}$in long by 7in high to $18\frac{1}{8}$ by $11\frac{1}{8}$in, against $15\frac{1}{2}$ by $9\frac{5}{8}$in to 28 by 20in. The lower thermal capacity, higher operating speeds and higher temperatures of the 400 c/s motors have not surprisingly resulted in a number of breakdowns. It is to be hoped that the steps being taken to rectify defects will prove successful, since much is still to be learned from desirable attempts to reduce weight and space per horse-power.

LIGHTING FOR PLANT GROWTH

Although records of research into the effects of light on plant growth date back to the 18th century, it is only recently that the full importance of light as a major growth factor has been appreciated and that satisfactory equipment has been available to enable artificial light to be used with advantage. Recent advances in the development of artificial light sources together with the increasing importance of using scientific methods in horticulture have resulted in considerable research on the subject, and in E.R.A. Report Ref. W/T31, which is reviewed briefly in this issue, Mr. A. E. Canham discusses the effects of different light conditions. The primary role of light in plant growth is as a source of energy and, as such, an essential factor in the reaction known as photosynthesis which takes place in the leaves of plants. The rate at which this process takes place depends on the quality and quantity of the light. At present artificial light is used only to supplement natural light and not to replace it. The colour of the light is of primary importance since it governs not only the rate of growth but also the shape and development of the plant. However, much work remains to be done both by the lighting engineer and the plant physiologist. In particular, improved light sources at competitive prices are needed.

AFRICAN POWER

From our frequent reports of development, proposed or authorized, in the continent of Africa, it would seem that within the next two decades this continent will occupy the attention of electrical engineers to an extent barely conceived at present. Recent weeks have seen the adoption of the Kariba scheme, a report on the Shire Valley scheme in Nyasaland, suggestions of more power stations in Uganda, and a report on a development of the Orange River in South Africa. Still under consideration is the Volta River scheme in the Gold Coast, while in Egypt work is developing on the electrification of the Aswan Dam. The aggregate cost of these schemes and others under consideration may well be of the order of £500 million—a formidable sum, in the spending of which it seems reasonable for British manufacturers to expect the lion's share as far as plant is concerned. In these areas, anxious for industrial expansion which with wise administration can probably do more than anything to satisfy African desires for higher living standards, and help racial integration, power supply leads the way and without it industry cannot progress. If the British electrical industry remains predominant in African development, the prospects for engineering exports of all kinds are likely to be good.

CONTROL OF COAL WINDERS

In the fourth article in the "Electricity in Coal Mining" series published in this issue the author says that "with the introduction of electric winding comes the opportunity of providing a degree of control and supervisory protection not possible on the steam winder . . . and of easing the task of the winding engineman which can be very arduous and exacting." This we believe is extremely fundamental and widespread throughout the electrical industry. "Degree of control" is the key phrase which points to greater reliability and greater precision of operation wherever there is an electrical function, be it a power drive or a heating scheme. Generally speaking, we do not doubt that, as the author asserts, electrification of our mine shafts is progressing as fast as manufacturing capacity and availability of power supplies permits, but is it progressing at a pace in keeping with the "degree of control" which governs the whole economic position of mine electrification?

Gears for Electric Drives

A Comprehensive Survey

By D. HARRISON, M.Eng., Ph.D., A.M.I.E.E.

THERE are many applications of electric machines where it is desirable, for economy of first cost and of space, that the electric motor or generator shall be run at a different speed from the machine to which it is coupled. There are also applications where a better layout is obtained if the driving and driven shafts are not parallel but at an angle to one another. In both these cases gears are used and this article is an attempt to give some information on this subject which will be of particular interest to electrical engineers. The very specialized problems of gear design and manufacture are not discussed, attention being confined to the application aspects.

Modern gears are made to very fine limits of accuracy, but this is of little use if, owing to incorrect choice of gear type, or bad installation or maintenance, excessive deflection under load and wear of bearings quickly results in misalignment of the gears. In view of the very wide field of application of all types of gear it is impossible to give more than a general survey, illustrated by typical examples.

The types of gear in general use may be classed into spur gears and helical gears, for both of which the input and output shafts are parallel and in the same plane; bevel and spiral bevel gears for which the shafts are at an angle in the same plane; and worm and hypoid gears where the shafts are at an angle in different planes.

For high speeds helical gears are preferred to spur gears, since in the former the load is transferred from tooth to tooth more smoothly and gradually, reducing the fluctuations of tooth load and the impact forces. This gives quieter and smoother running, permitting higher speeds. Spiral bevels have the same advantages over straight bevels. The type of gear chosen for a particular application depends on the power to be transmitted, the speed and the ratio. For high powers helical and spur gears are used, the former for high speeds and the latter for low speeds. Helical gears are also employed for low powers where the ratio required is small, whilst worm gears are commonly used for ratios from 5 : 1 to 60 : 1, for small to medium powers. Bevel gears are used to change the direction of drive, but are not normally used by themselves to give a large speed ratio. Hypoid gears are used for special applications, and may perhaps be regarded as intermediate between worms and bevels. Combinations of gear types are often used in double and triple reduction trains, and examples are quoted later.

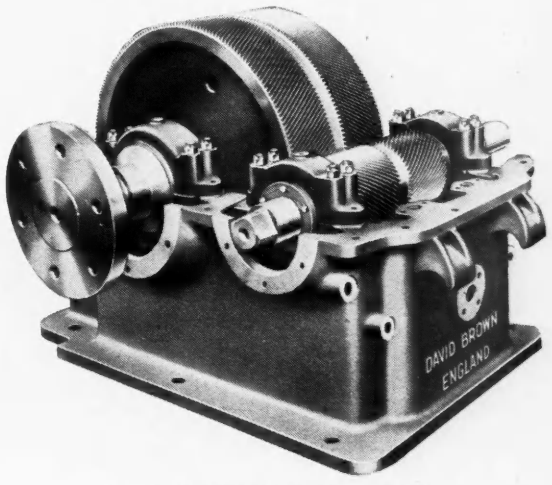
Generating Plant

For generator drives, with the exception of some small water-turbine units, mentioned later, the gears used are of the high-efficiency, double-helical type, running at high speed. In main steam generating stations, the turbines are direct-coupled to the alternators, but gears are sometimes used between the main set and the exciter. In some cases the exciter can be mounted with its shaft far enough below that of the main generator to permit a vertical disposition of the gears, thus saving some floor space. One such set comprised a 3,000 r.p.m. alternator with a 400 kW exciter running at 1,000 r.p.m. Gear drives of all kinds are used in connection with the power station auxiliaries such as pumps, fans, conveyors, etc. These drives are similar to those found in industry, and are dealt with below under that heading.

For smaller steam-turbine generator sets, either condensing or back-pressure, as found in private industrial stations, gears are very frequently used with a high-speed turbine and a lower speed generator. This is usually cheaper and more compact than a direct-coupled set. Two examples noted from recent installations are a 5,000 kW set, turbine speed 6,000 r.p.m., alternator speed 1,500 r.p.m.; and a 1,500 kW set, turbine speed 12,000 r.p.m., alternator speed 1,500 r.p.m. Four-pole, 1,500 r.p.m. alternators are usually chosen, since they are normally cheaper to construct than two-pole, 3,000 r.p.m. machines, while the saving in the cost of the gears owing to reduction in the speed ratio when the higher speed alternator is used, would be quite small. The ratio may be as high as 10:1, which would seem to be quite adequate for most requirements in this field, and the efficiency (usually better than 98 per cent) does not vary much with gear ratio.

Reduction gears are also employed for turbine driven d.c. generators, whose speeds tend to be rather lower than those of alternators, particularly for large powers. For instance, a set rated at 7,500 kW comprised a 3,500 r.p.m. turbine and a 500 r.p.m. generator. A smaller ship's set, rated at 550 kW, has a 6,500 r.p.m. turbine and 1,200 r.p.m. generator. Except for small units, where roller bearings are used, turbine gear bearings are of white metal, force lubricated. The gears themselves are lubricated and cooled by oil spray, and although the gear may have its own pump, cooler, etc., it is usually convenient to supply the gears from the turbine pump.

Cast-iron gear casings are preferred, not because fabricated steel cases are lacking in strength or rigidity when



Standard turbine double helical gear unit

properly designed, but because cast-iron is less resonant than steel. With modern fabrication methods and design, however, the difference, in practice, is negligible and where gears are subject to shock, fabricated steel cases are used (for example in ship's sets which may be required to withstand the shocks produced by gunfire or underwater explosion). The gear unit and turbine are preferably mounted on the same bedplate, and the turbine shaft coupled flexibly to the pinion shaft, with a solid coupling between the wheel shaft and the generator. To allow for differential thermal expansion between turbine and gear unit whilst permitting flexible coupling of the units, a claw or, more recently, a gear type coupling is often used.

While gear drives are not used for very large water-turbine generating sets, they are employed to a considerable extent in small stations, particularly to give reasonable speeds for alternators driven by low-head, low-speed turbines. Hence speed-increasing gears are required in these cases. The turbine may have a vertical shaft and the alternator may be of the vertical type or the more orthodox horizontal type. Where both machines are vertical, as in small units, double-helical speed-increasing gears are used. Horizontal alternators seem to be used for rather larger sets, and in this case the turbine is coupled to a speed-increasing helical gear unit followed by spiral bevel gears, though the latter may occasionally be employed alone, depending on the speed ratio required. Typical sets with horizontal generators and vertical turbines are one of 1,100 h.p., turbine speed 125 r.p.m., generator speed 1,200 r.p.m. and one of 3,600 h.p., turbine speed 208 r.p.m., generator speed 750 r.p.m. It is also of interest to note that some small water-turbine sets have employed worm gears as speed-increasing units, with ratios between 1 : 7 and 1 : 10, so giving the high ratio and change of shaft direction without using a double set of gears.

The application of gas turbines for power generation is so recent that no standards of practice have yet crystallized. In general, gas turbines run at very high speeds and double-stage helical gear units have been used so far, to give the high ratios required.

Without venturing into the field of gear design proper, some mention might be made here of certain limitations, with particular reference to helical gears, since it is chiefly high-speed, high-power turbine gears that are affected. In practice, it is found that if the pitch-line speed is too high, the gears will produce excessive noise and vibration. Due to improvements in manufacturing technique this limiting pitch-line speed has been raised, over the last 25 years, from about 10,000 ft per min to 18,000 ft per min, and in exceptional cases to 25,000 ft per min. The corresponding figure for spur gears is only about 4,000 ft per min although this can be increased by profile grinding to approximately 8,000 ft per min.

If the speed and ratio are both high, the maximum pinion diameter may be so small that in order to transmit the required torque, its face width must be greater than about $2\frac{1}{2} \times$ the pitch-line diameter. In this case, even though such a pinion is normally made solid with its shaft, the deflection under load will be excessive, and a third bearing is introduced between the helices to support the centre. This arrangement may also be required if the diameters of the gears have to be limited for space considerations. Even for high-power gears, some manufacturers have a preference for the single-helical type, as they can be fitted more accurately than double-helical, though the end thrust is not balanced out and must be accommodated by a thrust bearing or a special thrust collar.

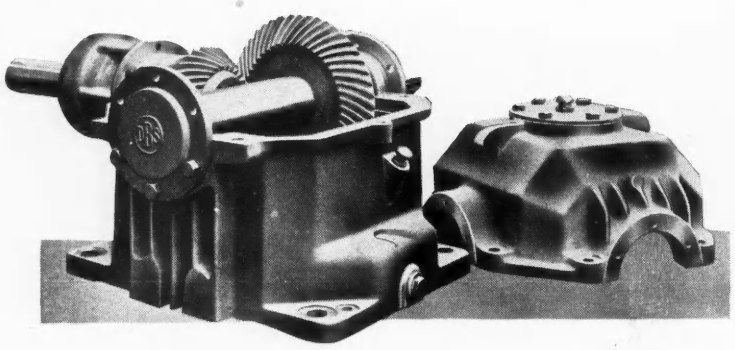
Industrial Applications

All types of gear are widely used with electric drives in every sphere of industry and although there are important exceptions, the usual requirement is for speed reducers, the motor speed being higher than that of the driven machine. Before going on to consider more typical industrial drives, the application of gears to large, electrically-driven, high-speed pumps, fans, blowers and compressors can be dealt with briefly. In these cases the driven machine may run at higher or lower speed than the driving motor, but the speed ratio is not usually very great. So far as the gears are concerned the requirements are the same as for the turbo-generators discussed previously, and the same types of high-speed, high-efficiency, double-helical gears are used. There may, however, be special problems due to cyclic torque variations, in which case special flexible couplings may be required to reduce the stress on the gears.

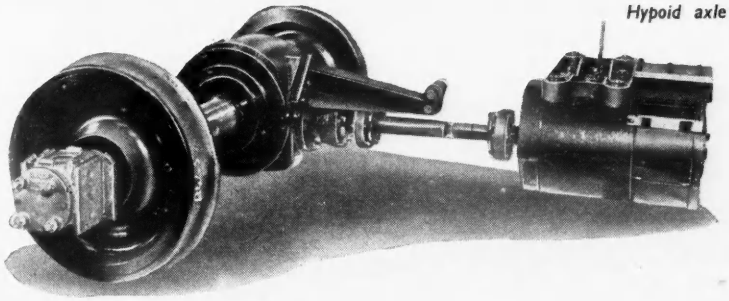
In general, the size and cost of an electric motor of given power is roughly inversely proportional to its speed, and slow-speed, multipole induction motors are also of lower efficiency and have poorer power-factor than high-speed machines, the magnetizing current and leakage-reactance being greater. Therefore it is not surprising that motors with 4, 6 or 8 poles, of approximate speeds 1,500, 1,000 and 750 r.p.m. respectively, should be normally used. These speeds are much too high for many industrial purposes, 200 r.p.m. or less being often required, so that gear ratios of 5 : 1 and over are quite common.

There is an increasing tendency to use worm gears for applications where helical or spur gears were previously used. Originally, worm gears were only used for very high speed ratios and low powers and were very inefficient, but developments in design and manufacturing technique

Typical rear axle gear for trolley-bus driv

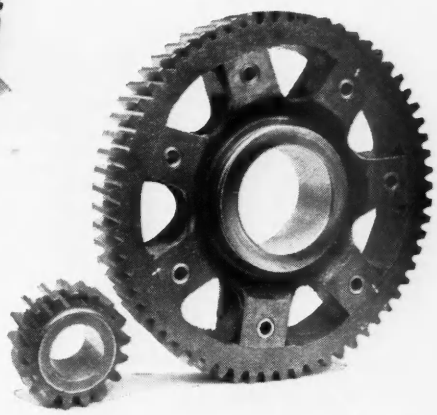


Spiral bevel unit



Hypoid axle unit on railcars of the new Toronto subway

Rubber bushed resilient gearwheel for electric traction



have improved them so much that they are now employed very widely for ratios of 5:1 and upwards and for powers up to 300 h.p. In general, except for ratios below 5:1 and for high powers, the modern worm gear is cheaper, more compact and quieter than other types of gear, and its efficiency is quite high. It is impossible to give exact comparisons of cost, but the following approximate figures may be of interest. The cost of a 25 h.p., 5:1 worm gear with worm speed of 1,500 r.p.m., would be about half that of the equivalent helical gear, and the efficiency, though not as high as that of the helical gear, would be about 95 per cent.

It is popularly supposed that worm gears are irreversible, but this is not so, though high ratio gears may have such a low reverse efficiency as to make this practically true. However, such gears have also a very low forward efficiency, usually less than 50 per cent. It is not always safe to rely on this feature of the high ratio gear to prevent reverse operation, since vibration from adjacent machinery can cause such a gear to creep, and it is much better to fit a proper brake. It is also possible for difficulties to arise with an " irreversible " gear if the driven machine has high inertia and low retarding torque, since when the motor is switched off the driven machine will try to drive the motor which is trying to slow down more quickly, and the gear may lock.

For speed ratios below 5:1 and for powers greater than those quoted above, helical or spur gears or a combination of these would normally be used. Again, where it is necessary for the output shaft to be parallel to the input, a worm gear is not suitable (unless a very high ratio, double-reduction unit is required), and single or double-reduction helical or spur gears would be used. For smaller powers single-helical gears are often used, the end thrust being taken up by angular contact or ball thrust bearings. The co-axial type of drive, in which the output shaft is in line with the motor shaft, usually employs double-reduction helical gears.

Ball or roller bearings are preferred for gearboxes, except for very high powers, because they maintain greater precision of gear location, they have low loss and they simplify lubrication. Except for high powers and high speeds, oil bath lubrication is usually adequate for most industrial gears. While it is possible to produce a neat design by incorporating the gearcase in the motor frame, it must be remembered that the heat produced by the gear losses must be dissipated, and the gearcase must have adequate area of surface for this. In particular, the load capacity of a worm reducer is largely determined by the temperature rise and not by the strength of the gears which can be reduced in size if the cooling is improved.

Whenever possible the gearcase should be mounted on the same bedplate as the motor, or alternatively bolted to flanges on the motor frame. The latter method is used with a vertical motor mounted above a worm gear to produce a unit requiring the minimum floor space and having a horizontal output shaft. It is desirable to fit flexible couplings to both input and output shafts of the gear.

Modern practice, for gears of all types, wherever space allows, favours totally-enclosed self-contained gearboxes, rather than the embodying of the gears in the driven machine. Separate gear units have the advantages of a reduction in cost due to standardization, greater reliability and longer life since gear alignment is accurately maintained, greater efficiency, and greater safety for the operator.

This practice, which has long been common for smaller powers, as shown by the wide use of standard gearboxes and geared motors, is now being followed to an increasing extent for low-speed, high-power drives, as required for such machines as ball-mills in cement works. Formerly it was common for the motor speed to be first reduced by a gear unit driving in turn a pinion which meshed with a coarse-pitch spur gear mounted around the drum of the mill, the " girthwheel." Owing to the difficulty of locating the gearbox accurately with respect to the mill, to the inevitable wear of the mill bearings and to the inefficient lubrication, it was impossible to maintain even reasonable alignment between the pinion and girthwheel. Moreover, the whole gear system was subject to heavy shock loads. A much better drive results if the girth-wheel and pinion are eliminated altogether, the whole speed reduction taking place in a separate gear unit, which is coupled to the mill, if necessary, by special means which prevent the gears being subjected to undue shocks.

Mechanical Handling Equipment

Many industries use mechanical handling of one form or another, and for this purpose worm drives are very common, since the powers and speeds required are eminently suitable. There may be exceptions to this rule, where the gear output shaft must be parallel to the input shaft, or where the disposition of the available space is the overriding factor. In the case of machine tools, this consideration is often of great importance and space limitations are often severe, requiring the use of bevel gears to change the angle of drive. In the textile industries, worm gears are also finding increasing application, for instance on carding machines. High-speed spindles, on the other hand, rotate faster than the driving motors, small helical speed-increasing gears being used. A sugar mill might

be driven from a high-speed motor with a helical gear single-stage speed reducer followed by a further stage of spur gear speed reduction, whilst calender drives might comprise worm gear speed reduction in two stages, or a worm gear followed by a helical gear.

In steelworks, the rolling mills, if driven by high-speed motors, employ helical gear speed reduction units, single-stage for ratios up to 8:1, double-stage for higher ratios. Roller drives commonly incorporate single, double or triple-stage reduction gears of the helical type, followed by bevels, whilst for the smaller auxiliary machines worm gears are used to an increasing extent.

Large electrically-driven mine winders use single-reduction helical gears, with single or twin motors, in the latter case the two pinions meshing with a single wheel coupled to the drum. Worm gears are often the ideal form for coal-getting machines and for conveyors underground and also for much of the plant for handling the coal above ground. Worm gears are also applied to cranes, paper-making machines, in brickworks, in rubber-making machines and in the chemical industry.

Electric Traction

All electrically-propelled vehicles use some form of reduction gearing between the motor and the driving-wheel axle, and special problems arise. When the vehicle is running over irregularities of track or road there will be relative movement between the motor, which is supported from the frame, and the axle, and the arrangement of the drive must allow for this, while at the same time maintaining accurate gear tooth engagement. For trolley-buses worm gear drives are frequently used, similar to those fitted on other heavy commercial road vehicles, the motor being mounted lengthways on the chassis, driving the back axle through a flexible transmission shaft which permits the required relative movement.

In tramcars, motor-coaches and many locomotives the motor is usually mounted with its shaft parallel to the axle, one side of the motor being hung from the axle and the other from the frame, so that about half its weight is spring-borne and half axle-borne. This arrangement maintains the pinion on the motor shaft and the gearwheel on the axle in correct mesh. Although spur gears are generally used with axle-hung motors, helical gears are also employed quite extensively. With spur gears, both pinion and wheel are often case-hardened and finished by profile grinding. The pinion is overhung on the motor shaft, and it is becoming the practice to taper the pinion teeth slightly at the motor end. This is designed to relieve the heavy end-loading which can arise from the misalignment due to shaft deflection and bearing clearances. For speed ratios up to 5:1 single-stage reduction is sufficient, but for ratios up to 20:1, which may be required for low-speed shunting locomotives, double reduction is used.

Axle-hung motor gears must be very robust, being subject to considerable shock loading, due to sudden relative movements between motor and axle. These shocks not only affect the gear teeth, but are also transmitted to the motor armature and may cause mechanical failures therein after a long period. The drive can be greatly improved by the use of a resilient gearwheel, which consists of a toothed rim attached to the centre by springs or by rubber-bushed pins. Owing to their torsional flexibility such gearwheels greatly diminish the shocks on gear teeth and motor, and, in the case of the rubber-resilient wheel, which has a limited universal flexibility, the gear and pinion are also self-aligning to some extent.

An alternative arrangement is used on some high-speed locomotives, with the whole motor weight carried on the frame, the gearwheel being mounted on a quill surrounding the driving axle, with a universal coupling between them. Sufficient clearance is allowed between the quill and the axle to permit the relative movement when crossing rail joints and points.

In motor-coaches for suburban and underground railways, where the motors must be located under the floor and space is therefore limited, it is advantageous to use small high-speed motors and a high gear ratio. Recently, motor-coaches for the Toronto subway have been equipped with hypoid, or "offset spiral bevel," gear drives, the motors being mounted with their shafts at right-angles to the axles, with a flexible connection between the motor and pinion, resulting in a drive somewhat similar to that of a trolley-bus. The gears are kept in accurate mesh by the use of taper-roller bearings. The hypoid gear, which is also used for automobile rear axle drives, is stronger than the normal bevel or spiral-bevel gear, since the pinion is of larger diameter for a given ratio and gearwheel size.

The foregoing survey is necessarily somewhat superficial, but if it helps electrical engineers to be more aware of the possibilities of geared drives, and of the particular fields in which each type can best be applied, it will have served a very useful purpose. In conclusion, the author would like to express his thanks to Messrs. David Brown & Sons (Huddersfield), Ltd., for providing information and illustrations for this article. Acknowledgment is also made to the Metropolitan-Vickers Electrical Co., Ltd., for additional information.

Load Control Course

A course of four lectures on load control by superimposed signals is to be held at the Borough Polytechnic, Borough Road, London, S.E.1, on Thursday evenings, beginning on 28th April. The subject refers to what is popularly known as ripple control. The aim of the course is not only to explain the principles of operation of different types of control and the response of the system to the higher frequency signals, but also to discuss the economics of its use as a means of improving load factor.

The first lecture, which is to be delivered by Mr. H. S. Petch (London Electricity Board), will be of an introductory nature covering the scope of the superimposed signal method and its applications and limitations.

The second lecture will be concerned with the time impulse principles of control and is to be delivered by Mr. L. C. Stagg (Metropolitan-Vickers Electrical Co., Ltd.) while the third lecturer, Mr. J. F. Mackenzie (Automatic Telephone & Electric Co., Ltd.) will deal with the rhythmic impulse principles of control.

The final lecturer will be Mr. E. G. Godfrey (Borough Polytechnic) who will discuss the analysis of power circuit response to superimposed signals. The lectures will be of about 1½ hours' duration and each will be followed by a discussion.

Electronic Digital Computers

A 146-page book has just been published which describes various aspects of the digital computer programme of the American National Bureau of Standards during 1953. The Bureau's computer programme has been conducted jointly by the Electronics Division and the Applied Mathematics Division. The work of the Electronics Division in Washington has included the development and construction of two computers (SEAC and DYSEAC), and the present book is based largely upon the work and experience relating to these two types. Such topics as systems development, engineering, development, design, construction, and maintenance of computer equipment are covered.

Copies of this volume are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $2.00.

WORLD ELECTRICAL MARKETS

Electricity in Norway

By HARALD MELTZER (Oslo)

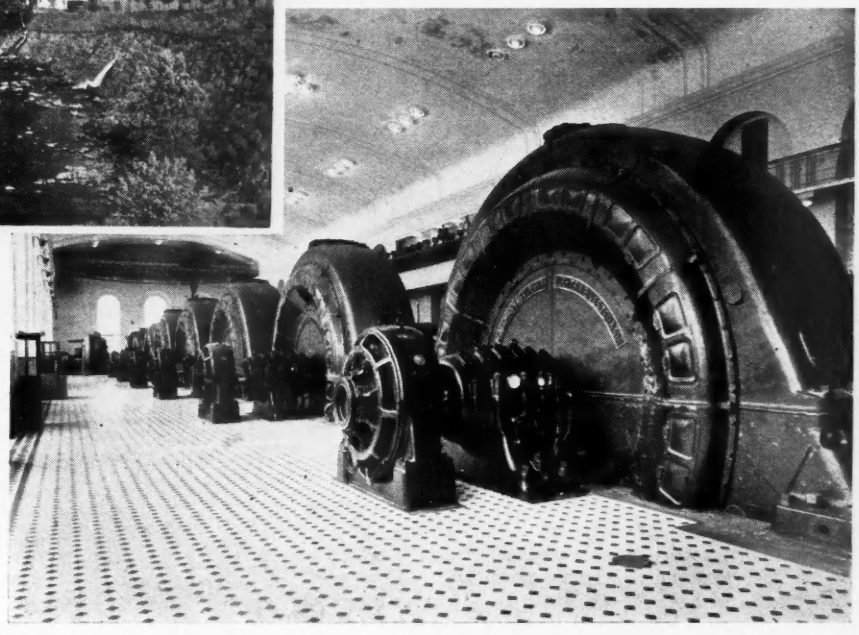
TO British visitors, the greater part of Norway must look rather barren and wild compared with their own country. With nine-tenths of the country covered by mountains and large forests, Norway will always have to import large quantities of goods to sustain its population of 3·5 million. Only 4 per cent of the land can be cultivated. The mountains contain some minerals, but only in limited quantities. Even so, Norway has one of the highest standards of living in the world. This is mainly due to a few factors including its merchant navy, its fisheries, its minerals and its waterfalls.

The country's waterfalls have provided Norway with power since the early Middle Ages. They are now the preponderant source of energy; only about 400,000 tons of low-grade coal is mined annually, on the island of Spitzbergen. Oil wells do not exist, nor does it seem possible to extract oil from shale as is done in Sweden.

The construction of hydro-electric power stations started in 1887. Fittingly enough, the first power station was built to supply a wood-pulp mill with energy. Until the first world war the power was obtained by the development of comparatively slow-flowing large rivers with small falls, in Eastern and Central Norway. Gradually, with better knowledge of rock blasting, work started on developing the higher waterfalls, especially in Western Norway. In 1912 the total installed capacity in Norway aggregated about 400 MW; by 1920 it had reached 1,250 MW, and in 1940 about 2,200 MW. During the last war a number of plants were completed and in 1945 the capacity was about 2,350 MW. Since then, a rapid expansion has taken place and large sums of money have been invested in the development.

The electricity produced is extremely cheap by reason of a combination of excellent natural reservoirs and relatively high falls. Some of the post-war power stations in Western Norway are on falls of up to 3,000ft. The average price heavy industry has to pay is about 0·0117 kroner/kWh for 6,000 hours' annual consumption. (One kroner=one shilling approx.) In addition to this there is another favourable factor, in that the relative price of hydro-electric energy is falling compared with other types of energy. Norway's electricity consumption has reached about 7,000 kWh per head annually. Since the end of the war hydro-electric production has more than doubled.

The present generating capacity is 3,900 MW and only



Exterior and interior views of the Saheim power station at Rjukan, Telemark, Norway

20 per cent of the total capacity is developed; it is estimated that it is economically possible to develop about 20,000 MW. If Norway carries on her present development programme, it will be another fifty or sixty years before all sources are exhausted. Two-thirds of the energy produced is consumed by industry. Norway, as a result of cheap power, has attracted industries in which energy plays an important role, besides industries based on domestic raw materials.

It is estimated that 585 MW was put into operation last year. The main increases were at Rossaga (120 MW) and Aura (142 MW). Two major power plants are now being discussed, both in Southern Norway. The most advanced is the Tokke project work on which will start this spring. It consists of five small and four large plants, one with four sets totalling 400 MW. The Tokke plants are scheduled to be completed by 1961 or 1962.

The production of electricity in 1954 was about 22 milliard kWh. The estimated demand in 1960 is somewhere between 31 and 35 milliard kWh, and in 1970 between 36 and 42 milliard.

Norway possesses various grid systems which are not yet linked together. The largest and most important system is in South Eastern Norway where three-quarters of all industry is situated. The two other main systems are in the Bergen and Trondheim areas. Work is in progress to link the various grid systems together. This will be of great advantage as the peak period occurs at different times in the various parts of the country. One great problem remains to be solved in connection with the grid system, that is, a standardized voltage. It looks, however, as if 300 kV is favoured.

Chemical and Metallurgical Industries

As a result of the abundance of electrical energy, Norwegian industry has developed along certain lines. There are very large electro-chemical and electro-metallurgical industries. The biggest firm in Norway is Norsk Hydro, producing nearly forty different products, ranging from magnesium metal and heavy water to fertilizers and polyvinyl chloride. Norsk Hydro also plans to start producing titanium metal. This firm alone consumes 20 per cent of all the electricity produced in the country and it accounts for 15 per cent of Norway's total exports.

The development of the aluminium industry, in which Norway played a major role for many years, was retarded by the war but now it is catching up rapidly. Last year a new 50,000 ton plant started operation, and it is expected that this year Norway's output will be 100,000 tons. In another five years the output may be increased to 160,000 tons.

Altogether, fifteen large smelting plants, all using electricity, are situated in the Norwegian fjords. They mostly produce various types of alloys such as ferro alloys, silico-manganese, ferrosilicon of all grades, and ferrochrome, low and high carbon. Minor quantities of other alloys such as silica-calcium, ferro-zirconium, etc. are occasionally produced, according to the demands of the market. As the ferro alloys are but little employed in the domestic market, the export of these products constitutes another important part of the country's income.

The production of steel covers only a minor part of the domestic consumption. In the eighteenth century Norway was a great iron producer, chiefly by the charcoal method. However, with the introduction of better methods, charcoal could not compete and the production of iron nearly ceased. At the moment the annual production of steel amounts to about 80,000 tons. This year, a big new steel mill at Mo Rana in Northern Norway will start up and it is expected that it will reach a production of 250,000 tons this year, all produced electrically. In private homes, electricity consumption is on the increase. Heating of homes by electricity is now gradually replacing the use of coal, coke, and wood.

The Norwegian electrical industry produces almost exclusively for the home market. It cannot, however, satisfy the entire demand and imports are considerable. These include turbines, generators, transformers, switchgear, etc. Production of turbines is now being stepped up to cover 75 per cent of the average annual demand, while the output of transformers is nearly sufficient to satisfy the market. The production of generators is not sufficient to meet the demand.

With the rapid post-war expansion of water power development, output has not yet caught up with demand and industry has orders for another four years on its books. The importation of power plant is considerable and will remain so for another few years. The main supplying countries in the post-war years have been Sweden, Great Britain and Germany. Germany had a very good market for electrical machinery in Norway before the war and is now doing its utmost trying to recapture it.

The domestic production of electric motors is limited to one factory with an annual output value of about £1,000,000. The main types range from one to ten h.p. Annual imports are valued at between one and two million pounds. Norway imports large quantities of fractional h.p. motors as well as large machines.

Standard types of electricity meters are produced although not in sufficient quantity to satisfy the demand. Voltmeters, ammeters, etc., are not produced at all, and Norway is entirely dependent on imports of these instruments. The domestic production of relays, switches, etc., has not caught up with the demand. The Norwegian cable industry is nearly large enough to meet the country's needs and is even able to export. The total output of the electrical manufacturing industry had a value of £11 million in 1954. In Norway, standards of quality and electrical and mechanical safety are rigidly enforced for all equipment and all electrical goods produced domestically. With the exception of large units such as generators, switchgear and transformers for the power distribution industry, practically all goods and equipment have to be submitted to the Board for the Testing and Approval of Electrical Equipment.

The British electrical manufacturing industry has already a good market in Norway in certain goods. As a small country, Norway can never expect to produce a wide variety of specialized electrical equipment and will have to depend on imports to a great extent. As already emphasized, before the war the German electrical industry had a very good market in Norway which it is anxious to recapture. British industry will, therefore, meet very sharp competition in this relatively small, but important, market. It is, therefore, imperative that British manufacturers should keep in close contact with Norway and be ready to adjust themselves to changing market conditions.

Cable-Sheath Fractures

DAMAGE to the sheathing of power cables installed on spaced supports above ground as a result of flexing due to temperature variations was the subject of a paper presented on 14th April by Mr. W. Holttum (British Insulated Callender's Cables) before the Institution of Electrical Engineers (Utilization Section). From theoretical and service examination of the behaviour of such cables, the author concluded that the length between supports, which is generally too short, was the most important factor. He described a method for determining the minimum length for both lead and aluminium sheaths to secure standardization.

VIEWS on the NEWS

By REFLECTOR

ONE is accustomed to thinking of windmills as structures that people want to preserve and in Holland I believe a society was formed some years ago with that end in view. I wonder whether as much objection was once raised to the erection of these ancient power machines as there has been in Caernarvonshire as regards their modern counterparts? During the discussion of Mr. E. W. Golding's I.E.E. paper on the wind-power generator of electricity, local opposition was given as the cause for delay in transferring the first 100 kW unit to its permanent site. Other days, perhaps, other customs. Or is the hostility merely in emulation of Don Quixote's exploit?

* * *

Although it is now seven years since the electricity supply industry was nationalized the complicated process of disentangling the assets of municipalities and the former electricity undertakings still continues. According to the *Liverpool Echo*, the chairman of the Finance Committee and the city treasurer "have been hammering out particular and detailed claims. The upshot is that they have salvaged for the city £53,112 out of what those in charge of the city's finances not unnaturally regard as a wreck." Another local authority which has been engaged in a similar task is Hornsey. The Borough Council is stated to have persuaded the Central Electricity Authority to accept payment of £12,140 in settlement of a claim of £42,617 relating to the adjustment of income tax liabilities when the former electricity undertaking was nationalized. So complicated was this matter, says the *Hornsey Journal*, that even counsel, who was furnished with a 30-page statement, had some difficulty in fully understanding its complexities.

* * *

At the inaugural luncheon of the new South of Scotland Electricity Board more than one speaker prophesied a bright and expanding future for the electrical industry. It also appears, however, to be afflicted by "contraction." I see that the *Evening Dispatch* (Edinburgh) has lost no time in conferring on the new Board the abbreviated appellation of "SOSEB" and it only remains now for the North of Scotland Hydro-Electric Board to become "NOSHEB"

* * *

A week or two ago I referred to the electricity supply breakdowns in the South Eastern Board's area caused by swans flying into overhead lines. This matter is also mentioned in the *Eastern Electricity Magazine*. Until recently, it says, the Bungay Branch "has been more famous for the frequent visit of the stork to members of the staff than for other reasons, but of late there has been a change of avian policy." On one short stretch of overhead line in the district two large swans have recently come to grief, one of the birds having a wing span of 6ft 7in and measuring 5ft 6in from beak to the tip of its tail. A third incident also occurred in which a power failure was caused when a flight of swans passed by, but this time there were no casualties. The writer says it is understood that consideration is being given to a method of marking the lines to avoid further trouble.

* * *

Some remarks by Sir Henry Self, deputy chairman (administration) of the Central Electricity Authority, at a meeting of the Merseyside and North Wales Electricity Consultative Council have "nettled the Welsh people," according to a writer in the *Liverpool Daily Post*. Sir Henry had expatiated on the benefits of hydro-electric development in Scotland where, he said "the waters of misery have been turned into pools of blessing." Would Sir Henry describe the rivers, lakes and waterfalls of Wales as "pools of misery" asks the *Daily Post* contributor? "Is it to see these miserable things that the tourists flock to Wales in their hundreds of thousands each year? Let it not be forgotten that there is gold in the hills and streams of Wales . . ." The writer should be careful about spreading such a rumour; some people might take it as literally as he has interpreted what Sir Henry Self said.

* * *

A Kingston-on-Thames reader writes in support of my remarks on the charge made for meters which, he says, "stirs the Scottish blood in me and is certainly bad sales policy." He suggests that if a housewife were asked by her butcher to pay an additional 2d for the use of the scales to weigh her meat she would feel aggrieved. I am sure she would—even without gaelic affinities. Though the overall cost may be no different, I am convinced that nearly all "extra" charges are psychologically wrong.

* * *

What must have been one of the first applications of the term "sandwich system" to technical education and training caught my attention in looking through the files of the *Electrical Review* of fifty years ago. In the issue of 14th April, 1905, comment was made on an address by Mr. W. J. Lineham to the Association of Teachers in Technical Institutes. The *Review* said:—

> "Everybody now knows that in every pursuit there is a theoretical and a practical side, and that to be proficient the two must be mixed together in suitable amounts. Until recently, it has been the custom to get the combination in two doses, one practical and the other theoretical, it being a matter of choice which dose was applied first, although opinion generally favoured the practical dose first, since a primary theoretical dose conduced to indigestion and want of assimilation of the subsequent practical dose. Latterly, opinion has been in the direction of a more intimate intermingling of the doses and of this there are, as Mr. Lineham indicates, the thick and thin sandwiches."

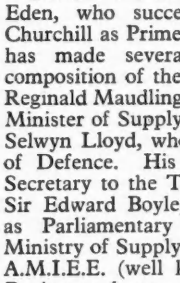
Speaking from experience, the writer expressed a preference for a "thick sandwich" which he considered had the better chance, since there was time for each layer to have some effect, and the application could be made under the most favourable circumstances.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Government Changes.—Sir Anthony Eden, who succeeded Sir Winston Churchill as Prime Minister last week, has made several changes in the composition of the Government. Mr. Reginald Maudling has been appointed Minister of Supply in the place of Mr. Selwyn Lloyd, who becomes Minister of Defence. His post of Economic Secretary to the Treasury is taken by Sir Edward Boyle, who is succeeded as Parliamentary Secretary to the Ministry of Supply by Mr. F. J. Erroll, A.M.I.E.E. (well known to *Electrical Review* readers as a former contributor of a Parliamentary commentary to our pages). Dr. C. Hill succeeds Earl de la Warr as Postmaster-General. Mr. D. Kaberry becomes Parliamentary Secretary to the Board of Trade (vice Mr. H. Strauss, who receives a peerage).

Mr. R. E. Livesley, B.Sc., A.M.I.E.E., who retired from the position of manager of the Newark District of the East Midlands Electricity Board on 31st March, has devoted the whole of his business career of over forty-five years to the electricity supply industry. For the last twenty-six years he has been associated with electrical developments at Newark-on-Trent, first as borough electrical engineer and latterly as district manager of the Board. Mr. Livesley was educated at the Hulme Grammar School and is a graduate of Manchester University. In 1910 he entered the Manchester Corporation Electricity Department as an apprentice and after four years he was appointed technical assistant. From 1915, until he joined the Royal Naval Reserve two years later, he served with the Stretford U.D.C. undertaking as a shift engineer. On demobilization, as engineer sub-lieutenant in 1919, he became shift engineer at Stockport and after a short term with Birmingham Corporation in the same capacity he was appointed power station superintendent at Aylesbury in 1925, being promoted to chief assistant in 1928. The following year he was appointed borough electrical engineer and manager at Newark.



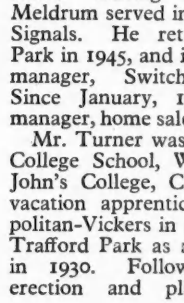
Mr. R. E. Livesley

Mr. H. W. Woodruff, Trade Commissioner and economic adviser to the High Commissioner in the Federation of Rhodesia and Nyasaland, will be leaving Salisbury for the United Kingdom at the end of May on completion of his tour. He will be succeeded by **Mr. J. W. Stoodley,** at present serving as Trade Commissioner, Grade II, in Pretoria. **Mr. G. W. McNeil,** O.B.E., formerly Trade Commissioner at Chittagong, and at present serving in the Commercial Relations and Exports Department of the Board of Trade, will leave for South Africa on 21st April to fill the vacancy at Pretoria.

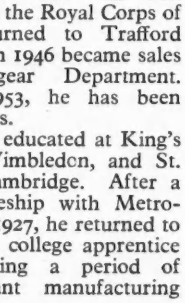
Mr. J. P. A. Meldrum, O.B.E., B.Sc., M.I.E.E., and **Mr. R. H. S. Turner,** M.A., M.I.P.E., have been appointed directors of Metropolitan-Vickers Electrical Co., Ltd.

Mr. Meldrum was educated at Rugby and Glasgow University. After a vacation apprenticeship with the Metropolitan-Vickers Electrical Co. in 1924, he joined the company as a college apprentice in 1926, later becoming a special switchgear trainee. In 1930 he was appointed to the staff of the Switchgear Engineering Department. During the last war Mr. Meldrum served in the Royal Corps of Signals. He returned to Trafford Park in 1945, and in 1946 became sales manager, Switchgear Department. Since January, 1953, he has been manager, home sales.

Mr. Turner was educated at King's College School, Wimbledon, and St. John's College, Cambridge. After a vacation apprenticeship with Metropolitan-Vickers in 1927, he returned to Trafford Park as a college apprentice in 1930. Following a period of erection and plant manufacturing work, he became assistant superintendent, Instrument and Meter Department, taking charge of a shadow factory producing aircraft instruments from 1940 to 1944. In 1948 he was appointed superintendent, Plant Department, and in 1952 assistant works manager, Main Works. Since April last year he has been works manager, Trafford Park Works. Mr. Turner is a past president of the Manchester Section of the Institution of Production Engineers, a member of the Regional Committee, and a member of Council.

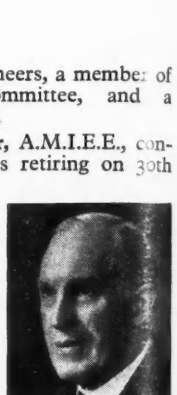


Mr. J. P. A. Meldrum



Mr. R. H. S. Turner

Mr. F. G. Baxter, A.M.I.E.E., consumers' engineer, is retiring on 30th May next from the Lancaster and Morecambe District of the North Western Electricity Board, a position he has held with the Board and its predecessors since 1927. Mr. Baxter was educated at the Gravesend Technical School and Woolwich Polytechnic. He served his apprenticeship with the Northfleet Engineering Works, and on completion of his apprenticeship he was appointed chief assistant electrical engineer for the Associated Portland Cement Manufacturers. Later he was installation engineer with the Stepney electricity undertaking. In 1912 he went to Vickers, Ltd., Barrow-in-Furness, and left in 1922, holding the position of senior electrical draughtsman, to take up a position as technical assistant with the Barrow Corporation Electricity Department. In 1927 Mr. Baxter became consumers' engineer to the Lancaster Corporation Electricity Department, and was responsible for the electrical development of the undertaking which, up to the time of his appointment, had no showrooms or development activities. When the undertaking was taken over by the North Western Electricity Board, the district of Morecambe and Heysham was added to the area. His private address is "Oubeck," Galgate, near Lancaster.



Mr. F. G. Baxter

Mr. E. K. Cole, chairman and managing director of E. K. Cole, Ltd., has recently returned home after completing an extensive overseas business tour covering the West Indies, South and Central America, the United States and Canada.

At the recent annual general meeting of the Liverpool Branch of the Electrical Contractors' Association **Mr. W. Winstanley** (Winstanley & Lambert, Ltd.) was elected chairman for the ensuing year and **Mr. J. Pinnington** (James Heaney & Co.) was elected vice-chairman.

Mr. F. Banfield, general manager of the Expanded Metal Co., Ltd. has been appointed managing director. He succeeds **Lt.-Comdr. G. C. Hans Hamilton,** who retains his position

as chairman of the company. Mr. Banfield joined the company in 1924 as an office boy at their Westminster offices. Before being appointed general manager, he was successively chief clerk, and in charge of the development of aluminium sales.

Mr. S. Tillotson, who, as we have already reported, retired from the position of manager of the Tees Sub-Area of the North Eastern Electricity Board on 31st March, recently received a presentation of a picnic case and car trays, a pair of candelabra and a tea set from his colleagues. The presentation was made by Mr. E. J. Grubb, the Sub-Area engineer.

Lord Citrine, chairman of the Central Electricity Authority, is to have the honorary degree of LL.D. of the University of Manchester conferred upon him on 11th May.

A joint statement by the Uganda Government and the Uganda Electricity Board says that **Sir Charles Westlake,** M.I.E.E., chairman of the Uganda Electricity Board, is going on leave pending retirement on 1st October next. Sir Charles will be succeeded as chairman of the Board by the present deputy chairman, **Mr. W. D. D. Fenton.**

Sir Charles Westlake

Sir Charles became the first county electrical engineer of Dumfriesshire at the age of twenty-nine and was responsible for the design of the Dumfriesshire electrification scheme. Two years later, he was appointed chief engineer and manager of the newly-constituted Electricity Board for Northern Ireland. In 1936 he became general manager of the Finchley Corporation electricity undertaking. In the last war Sir Charles was a major in the Home Guard and in 1943 he became a lieutenant-colonel on the "D" Day planning staff. He held the office of chief fuel and power officer, North-West Europe.

After the war the Secretary of State for the Colonies appointed him to lead a mission to East Africa to report on electricity supply problems in the three territories. This report was presented in 1946, and the following year, at the request of the Uganda Government, he spent two months in the Protectorate preparing a report on the power potential at Owen Falls, Jinja, and possible markets for electrical power. The report was adopted by the Uganda Legislative Council which subsequently appointed Sir Charles chairman of the Uganda Electricity Board. He took up the appointment in January, 1948. In 1949 Sir Charles was asked by the Government to set up a cement

Mr. J. M. Goodall

Mr. J. H. Cansdale

Mr. M. W. T. Rees

Mr. C. W. Pearce

industry at Tororo, and he was chairman of that industry's board until 1951. He also served for a time on the board of the Uganda Development Corporation and two of its subsidiaries. A knighthood was conferred on him when the Queen visited Uganda last year to inaugurate the Owen Falls Scheme. Since February, 1954, he has served as a crossbench member on the Uganda Legislative Council.

Mr. Fenton, who is a barrister as well as an electrical engineer, has had a wide experience with large electricity undertakings in the United Kingdom, and before going to Uganda in January last was secretary and commercial engineer of the North of Scotland Hydro-Electric Board.

Mr. J. M. Goodall, M.I.E.E., has been appointed consulting switchgear engineer to the British Thomson-Houston Co., Ltd. After completing a course in electrical and mechanical engineering at Finsbury College, Mr. Goodall joined the company as an engineering apprentice in 1908, and in 1911 joined the staff of the Switchgear Department, moving to London in 1913 when the company transferred the manufacture of switchgear to the Willesden Works. As a member of the Switchgear Engineering Department, Mr. Goodall has been closely identified with the development of switchgear over the past thirty-five years.

In addition to the appointment of Mr. W. B. G. Collis as manager of its Traction Department, as previously announced, the British Thomson-Houston Co., Ltd., has decided to reorganize that department to cater for the expanding growth of railway electrification. **Mr. J. H. Cansdale,** M.I.E.E., in addition to his duties as deputy manager, Traction Department, will in future be primarily responsible for all contracts. **Mr. M. W. T. Rees,** B.Sc.(Eng.), A.M.I.E.E., Assoc.I.Mech.E., has been appointed assistant manager (projects) of the Traction Department. Mr. Rees served a student apprenticeship with the company and joined the D.C. Engineering Department in 1935, transferring to the Marine Department in 1949 in which he was appointed assistant manager in 1951.

Mr. C. W. Pearce retired from the British Thomson-Houston Co., Ltd., on 31st March after more than forty-four years' service with the company. After serving his apprenticeship with Veritys, Ltd., Mr. Pearce joined the B.T.H. Test Department in 1911 and three years later transferred to the control gear drawing office for a short time before joining H.M. Forces at the outbreak of the 1914-18 war. He served in the Royal Engineers and the 11th Division Signal Company until the end of hostilities, and then rejoined the B.T.H., returning to the drawing office before being appointed a commercial engineer in what was then known as the Supply Department. Upon the formation of the A.E.I. Group in 1929, Mr. Pearce was appointed liaison representative between the B.T.H. and M.V. on motors and control gear. Subsequently he was transferred to the newly-formed B.T.H. Industrial Sales Department to take charge of the service section dealing with industrial motors and control gear. Mr. Pearce remained in charge of this section until the end of 1947 when he was appointed service engineer to the company. In 1953 he was appointed personal assistant to Mr. G. S. C. Lucas, director and chief electrical engineer.

Sir Charles J. Hambro, K.B.E., deputy chairman of Hambros Bank Ltd., and a director of other companies, has been appointed a member of the court of directors of Cable and Wireless (Holding) Ltd.

The Commonwealth Relations Office has appointed **Mr. J. G. Park,** M.I.E.E., as an electrical engineering adviser to the Government of Ceylon under the Technical Co-operation Scheme of the Colombo Plan. Mr. Park, who has been seconded for this purpose by the Eastern Electricity Board, left this country for Colombo on 5th April, and he will probably remain in Ceylon for about two years. Educated at Bootham School and Manchester University, he joined the Lancashire Electric Power Co. in 1930, and was subsequently with the Electricity Board for Northern Ireland, the Metropolitan Electric Supply Co., and the Northmet Power Co. before entering the service of the Eastern Electricity Board in 1948. As

Mr. J. G. Park

a member of the 1946 Hydro-Electric Mission to East Africa, which was led by Sir Charles Westlake, Mr. Park visited Kenya and Tanganyika in that year when he was engaged in the investigation of the existing and potential electricity supply position in those territories.

Upon the taking over of generation and distribution of electricity in Southern Scotland by the South of Scotland Electricity Board, **Mr. C. W. Marshall,** controller of the South West Scotland Generation Division of the British Electricity Authority (now C.E.A.), has retired as from 31st March.

Mr. W. N. Kilner, M.I.E.E., has been appointed chief engineer of the Metropolitan-Vickers Electrical Co.'s newly formed Turbo-Generator Engineering Department. **Mr. C. P. Holder,** B.A., M.I.E.E., is assistant chief engineer of the Plant Department, and **Mr. E. Nicholson,** M.B.E., T.D., B.Sc., A.M.I.E.E., is assistant chief engineer of the Switchgear Department.

Mr. Kilner joined M-V in 1924, in the turbo-generator section of the Plant Engineering Department, where he has been responsible for the design of many of the largest generators installed at C.E.A. power stations. In 1946 he was appointed assistant chief engineer. He is chairman of the Turbine Type Generators Technical Committee of the International Electrotechnical Commission, and was chairman of the Supply Group Committee of the North Western Centre of the I.E.E. for 1952-53.

Mr. Holder took his degree at Queens College, Cambridge, went to M-V as a college apprentice in 1931, and on completing his course joined the General Engineering Department. In 1936 he transferred to the Plant Engineering Department, since when he has specialized in the design of salient pole a.c. machines. In conjunction with Mr. E. M. Johnson he has read two papers on that subject before the I.E.E.

Mr. Nicholson was educated at Denstone College and Manchester University. He became a probationary college apprentice with M-V in 1933, and on completion of his course in 1938 joined the Switchgear Department. From 1939 to 1946 he served with the Royal Corps of Signals in North Africa and Italy, being awarded the M.B.E.; he also received the Legion of Merit (U.S.A.). Returning to the Switchgear Engineering Department in 1946 he became division leader (large panels) in 1951.

Mr. W. N. Kilner

Mr. C. P. Holder

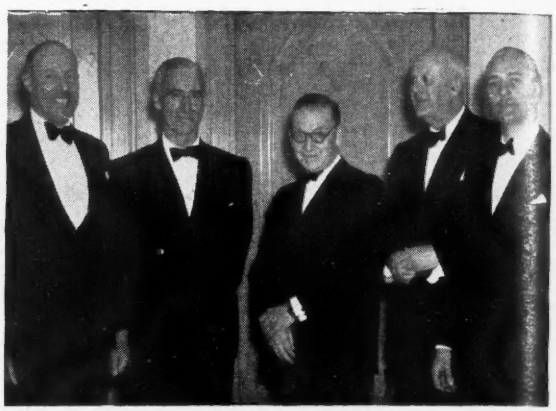
Mr. E. Nicholson

Mr. J. Maitland Jones, of Turnbull & Jones, Ltd., Wellington, New Zealand, will be retiring from the company at the end of this month after having completed a period of fifty years' service on the staff. A nephew of one of the original founders of the company, Mr. Maitland Jones came to London in 1919 and from then until 1947 was in charge of the London office. Apart from a brief return during the early 1950's, he has since been at the head office where he latterly took up the appointment of factory superintendent.

Mr. A. M. Beresford-Cooke, who has been appointed senior planning engineer of the Independent Television Authority, started his television career in 1936 in the E.M.I. research laboratories. In 1938 he joined the B.B.C. at Alexandra Palace. During the war, as a major, he served in A.A. Command on radar where he became chief R.E.M.E. radar officer. Since 1946 Mr. Beresford-Cooke has been a senior member of the television section of the B.B.C.'s Planning and Installation Department, where he has played an important role in the development of the post-war television studio and outside broadcast engineering activities.

Mr. R. C. Harman, A.M.I.E.E., who has been appointed superintendent engineer (operations and maintenance) of the I.T.A. joined the B.B.C. in 1935 at the Daventry short wave transmitting station. He transferred to television at Alexandra Palace late in 1937 and returned there after the war as senior engineer, transmitters. In 1949 he was transferred to the Sutton Coldfield transmitter where since January 1952 he has been engineer in charge.

Mr. W. N. Anderson, A.M.I.E.E., has been appointed senior lines engineer with the I.T.A. He joined the B.B.C. Designs Department in 1948 and worked on the design of test equipment for television transmission circuits. Later transferring to the Planning and Installation Department, he was responsible for the development of radio link equipment and technique for television O.B. purposes, using centimetric waves. He was also responsible for planning the radio links for the television broadcasts from France in 1950-51. Mr. Anderson received his early technical training with E.M.I. research laboratories where he was employed for eight years, working on s.h.f. measurements and v.h.f. television link problems.



Mr. S. H. Harding (national chairman), Mr. Bryan Donkin (president), Sir John Cockcroft, Sir Norman Kipping, and Mr. E. A. Bromfield (general secretary) at the recent A.S.E.E. annual dinner reported in our last issue

Mr. I. S. Petherick, A.C.A., has been appointed secretary of "Diamond H" Switches, Ltd. Mr. Petherick was educated at Westminster School and during National Service shortly after the war was commissioned in the Royal Tank Regiment. Before his appointment he was a partner in a London firm of accountants.

Mr. I. S. Petherick

In the Merseyside and North Wales Electricity Board's No. 4 Sub-Area (which covers the six North Wales counties and parts of Cardiganshire, Shropshire and Cheshire) a considerable extension of supply has taken place during the past few years. The Sub-Area extends over 3,989 sq miles, and recently the Board decided to reorganize the present District organization by placing each of the eight Districts under the supervision of a district manager, while retaining the present posts of district engineer and district commercial officer. The new district managers have now been appointed. All previously held appointments with the Board, and have taken up their new duties this month. They are:—

Crewe, **Mr. A. D. Hegan** (previously district commercial officer, Crewe). Wrexham, **Mr. E. J. Brett** (previously district engineer, Wrexham). Oswestry,

Mr. W. A. Williams (previously district commercial officer, Oswestry). Rhuddlan, **Mr. L. V. Taylor** (previously district engineer, Rhuddlan). Conway, **Mr. J. A. Winchester** (previously district commercial officer, Rhuddlan). Caernarvon, **Mr. E. W. Griffiths** (previously district engineer, Caernarvon). Anglesey, **Mr. Ll. Lewis** (previously district commercial officer, Anglesey). Aberystwyth, **Mr. J. L. Williams** (previously senior development assistant, No. 4 Sub-Area headquarters).

Mr. R. P. Mason, commercial manager, and **Mr. C. L. Chapman,** chief development engineer, of Venner Accumulators, Ltd., are leaving England on 27th April to attend the 1955 conference of licencees of the Yardney International Corporation to be held in New York. Each year the associated members meet to compare improvements to the silver-zinc accumulators of the Andre Yardney method. **Mr. J. M. Brooke,** managing director of Venner Accumulators, will also attend the conference during its session.

Mr. H. T. Greatorex has been appointed assistant head of the Engineering Information Department of the B.B.C.

Mr. F. A. King and **Mr. A. J. Hughes** retired from the board of Kelvin & Hughes, Ltd., on 31st March, after some sixty years of service with the company. The Hughes family have been associated with navigational instruments since 1740 and Mr. A. J. Hughes was closely connected with pioneer development of the echo sounder, the aperiodic compass and the air sextant. Mr. King spent a good deal of his business life in the Kelvin factory at Glasgow and in his early days was closely associated with Lord Kelvin and the many instruments which he designed.

Mr. F. W. Bates, who first joined the company as an apprentice in 1927, later becoming general works manager, has now been appointed to the board of Kelvin & Hughes, Ltd.

Mr. H. S. Kirk has been appointed to the board of Electro-Mechanical Supplies (Leicester), Ltd. He gained sales and electrical experience with the General Electric Co., Ltd., and served in the Electrical Branch of the R.A.F. during the war.

Mr. H. S. Kirk

Mr. W. S. Harlow, A.M.I.E.E., formerly of the C.E.A., London (Transmission Department), has joined the staff of W. T. Glover & Co., Ltd. Mr. Harlow has left for Cape Town to take up the appointment of overseas sales engineer, South Africa.

Mr. J. S. Pickles and Lord Citrine examining a painting of power lines across the border, presented to the C.E.A. by the South of Scotland Electricity Board at the recent inaugural luncheon of the Board. The oil painting of Braehead power station presented to the Board by the C.E.A. is on the left

Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., disembarked at Tilbury on 5th April after an extensive business tour in the Far East. Mr. Scott left this country on 4th January, and during the last three months has been visiting the company's branches and agents in Burma, Ceylon, India, Malaya, Pakistan and Thailand.

Councillor Norman S. A. Grubb, electrical contractor, of New Romney, has been selected as Mayor of New Romney for the ensuing year.

Sir Percy H. Mills, Bt., K.B.E., has joined the board of Lancashire Dynamo Holdings, Ltd., and **Mr. J. G. Shaw** has resigned from the board. Mr. Shaw, however, remains a director of some companies within the Lancashire Dynamo group.

To mark his retirement, **Mr. R. R. Brown,** secretary of the Ayrshire Sub-Area of the South West Scotland Electricity Board, recently received a presentation from the Sub-Area staff. The presentation was made by Mr. A. E. Roots, Sub-Area manager.

The B.B.C. announces the appointment of **Mr. T. P. Douglas,** M.B.E., as engineer-in-charge, Sutton Coldfield television transmitting station. Mr. Douglas joined the B.B.C. in 1938 as a junior maintenance engineer at the Daventry transmitting station. During the war he held a commission in the Royal Corps of Signals and was a prisoner of war in Siam. He was awarded the M.B.E. in 1948 in recognition of his services while in captivity when he was actively engaged in radio work. Mr. Douglas returned to the B.B.C. at Daventry in 1946. He was transferred to Kirk o'Shotts television station in 1951 and in 1953 became the assistant engineer-in-charge of the Sutton Coldfield station.

Mr. J. W. Moore, technical manager of Silentbloc, Ltd., has been appointed general manager of the company.

At the April luncheon of the **Electrical Industries Club** which was held at the Connaught Rooms, London, on Tuesday last, the guest speaker was Chief Officer R. W. Moreton, who entertained about 130 members and guests by a realistic talk on the general experiences of the British North Greenland Expedition, with which he spent two years in Greenland as stores officer.

Mr. E. H. Willats has taken up duties as chief draughtsman at Magnetic Devices, Ltd., Newmarket.

OBITUARY

Mr. Joseph S. Webber, founder and chairman of "Pifco," Ltd., died on 31st March in his eightieth year. Mr. Webber founded the company in 1900, and from a small shop selling gas mantles he built up a world-wide organization which now markets a wide variety of electrical appliances, accessories and associated merchandise. Mr. Webber leaves a widow, two sons (of whom Mr. Alfred D. Webber is managing director of the company) and a daughter.

The late Mr. J. S. Webber

Mr. J. T. Allen, A.M.C.T., A.M.I.E.E., of Lancashire Dynamo & Crypto, Ltd., died suddenly on 2nd April. He was sixty-two. Mr. Allen had been with the company at the Trafford Park works since 1910 when he joined as an apprentice. He entered the Service Department in 1914, was for a short period in 1927 head of the contracts section and in 1928 was made head of the Service Department, which position he held until his death. Mr. Allen is survived by his wife and daughter.

Rating and Valuation Bill

THE Rating and Valuation (Miscellaneous Provisions) Bill, which was given a second reading in the House of Commons last week, deals with the procedure which will be followed when the revaluation of property for rating purposes has been completed by the Inland Revenue. The principal change in the procedure laid down by the 1948 Rating and Valuation Act, which set in motion the present revaluation—the first for 20 years—is that ratepayers will not be able to see the draft valuations in the autumn this year. They will not know their assessments or the actual rates they will have to pay until the rates are levied on about 1st April, 1956, or just before.

Explaining this change, Mr. W. F. Deedes, Parliamentary Secretary, Ministry of Housing and Local Government, said that under the 1948 Act, the ratepayer would only have been told his new assessment in the autumn, but would not have been told the figure that he was most concerned about, namely, the rate he would have to pay. If the ratepayer judged the change merely by the assessment, there might be a flood of appeals and this would clog the machine in the initial stages. Any revision obtained would be retrospective to 1st April, 1956.

Another provision in the Bill related to pool payments, he said. Under Part V of the 1948 Act the British Transport Commission and the Central Electricity Authority made each year a lump sum payment instead of paying rates on their individual properties throughout the country. But the local authorities and other parties concerned had requested that there should be a review of these payments and the Government therefore proposed to carry out a general review of Part V in the first year of the new valuation lists. Pending this review, all questions on the mode of payment were in suspense. The exact scope of the review would be decided later.

The present Bill laid down a new system for assessing gas industry premises. In effect, it took the total rateable value of the properties occupied by the Gas Boards in May, 1949. It applied to it annually a formula calculated from the number of therms sold by each Board and then apportioned the adjusted rateable value of the Boards among the rating areas concerned. This would be retrospective to 1st April, 1952, and would entail adjustments to the Exchequer Equalization Grants and the rates paid by Gas Boards for the period 1952-53 to 1955-56.

Mr. Deedes said that certain trade organizations had expressed anxiety lest the revaluation should throw an unfair burden upon them as compared with ordinary householders. The Government had given a pledge that as soon as the effects of the revaluation could be fully measured, it would review the position and consider whether any changes were necessary. That promise still stood, but there had been misunderstanding about it. Some people had taken it to mean that the effect would be measured when the draft lists were to have been available, in October, 1955, and that changes could have been made between then and 1st April. But that would be wholly impossible.

Mr. Lindgren said that the standard payments of the Central Electricity Authority and the British Transport Commission were varied up or down according to the average level of rate poundage throughout the country. If rateable values went up but the rate poundage was reduced by a half, the C.E.A. and the B.T.C., because of the fixed standard, would pay only half the rates. He knew that this was oversimplifying the matter because in the case of electricity there was a slight variation on kWh sold, but on the actual pool payments, which were based on 1948 value, these bodies would pay only half rates. Local authorities would be £11 million down. He could not see why the C.E.A., British Railways and the Gas Boards should be excluded from the general provisions of revaluation and, as a result of a higher rate being levied on other people, should have their rate reduced by one half. Clearly, in Committee, the global sums to be paid by these bodies would have to be examined with a view to revision.

Mr Enoch Powell, who is an expert on this subject, said that one defective feature of the 1948 Act was being avoided in the new procedure for Gas Boards. Instead of them paying—as did the C.E.A. and the Transport Commission—on the basis of the average rate poundage levied throughout the country, they would pay in accordance with the actual rate poundage payable in any particular area. Another defect in the 1948 Act was that local authorities with large electricity producing hereditaments in their areas, found themselves faced—over a period of transition—with a very big loss in rateable value because no account was taken by the formula of the amount of property actually situated in each rating area. Here in this new formula for the Gas Boards almost as much weight was attached to the amount of gas produced as the amount consumed. Therefore those rating authorities in which large gas plants were situated would not lose a great part of their rateable value, as those authorities in whose areas electricity plants were situated had lost and were continuing to lose under the 1948 Act formula. Had electricity and transport hereditaments continued to be rated on the profits basis, their valuations and the rates they were paying would be higher to-day than they were under the 1948 Act.

Mr. Sandys, replying to the debate, said that by synchronizing the publication of the valuation lists with the fixing of the rate poundage, the ratepayer would be saved a great deal of worry and possibly expense. When he saw the two figures side by side he might find that it was quite unnecessary to consider an appeal.

New B.I.F. Arrangements

From next year onwards the British Industries Fair is to be held in two parts. Consumer goods, including textiles, clothing, leather goods, toys and games, jewellery, stationery and fancy goods, will be shown at Earls Court, London, from 22nd February to 2nd March, 1956. From 23rd April to 4th May exhibits from other lighter industries—e.g., packaging, chemicals and office appliances—will be accommodated at Olympia, London, while the engineering, hardware, etc., industries will show at Castle Bromwich, Birmingham, as usual. It is possible that the changes may involve some adjustment between the industries showing in London and Birmingham.

It will be recalled that last year a special company, British Industries, Fair, Ltd., was formed to take over the London section of the B.I.F. from the Board of Trade and run it as a commercial undertaking. The company is also responsible for home and overseas publicity for the Fair as a whole, although the management of the Birmingham section remains in the hands of the Birmingham Chamber of Commerce.

In making the announcement regarding the dual-period arrangement British Industries Fair, Ltd., states that Mr. Kenneth Horne is to become full-time managing director of the Fair; he is already one of the six directors of the company. Mr. Horne will relinquish his present position as sales director of Triplex Safety Glass, Ltd., with whom he has been for 27 years. Mr. Horne is, of course, very well known in a quite different sphere. He will take over from Mr. J. L. Reading, who was general manager of two previous Fairs and was lent to the new company by the Board of Trade to help the company in its first year.

This year's Fair is being held at Olympia and Castle Bromwich from 2nd to 13th May and will be on the same lines as before, and Sir Ernest Goodale, the chairman of British Industries Fair, Ltd., has said that much has been done to make the Olympia display "attractive, animated and essentially a business proposition." Sir Ernest also says that "the changes of date will meet the major criticisms of a number of industries that the Fair is held at the wrong time of the year."

INDUSTRIAL NEWS

Plumber Jointers' Wages

The Standing Joint Committee on Plumber Jointers of the Joint Industrial Council for the Electrical Cablemaking Industry has agreed terms of settlement of the application of the trades unions for an increase in wages to plumber jointers and to other grades coming within the scope of the plumber jointers' agreement.

It has been agreed that:—(a) The rates of pay for plumber jointers, both in London and in the rest of the country, shall be increased by 4d an hour; (b) Consequential increases shall be made in the rates of pay of plumber jointers' mates, of learners and probationers and of youths and boys; and (c) These increases shall become effective as from the beginning of the first full pay period following 5th April. With the addition of these increases the new rates of pay for plumber jointers will be: 4s 5¼d an hour in the London area, and 4s 1¾d an hour throughout the rest of the country.

In regard to the new rates for plumber jointers' mates, it has been further agreed that at 85 per cent of the plumber jointers' rates these shall be as follows: In the London area, 3s 9½d an hour; throughout the rest of the country, 3s 6¼d an hour.

Cablemaking Classification

The Joint Regrading Committee of the Joint Industrial Council for the Electrical Cablemaking Industry has decided on the following revisions of the classification of occupations applicable to male workers. Occupation No. 20—Testing:—Lead capping and sealing: The existing classification to be deleted and substituted by Lead capping and sealing all cables, 4. Preparing paper cables: The existing classifications to be amended as follows:—Preparing paper cables up to and including 11 kV, 3; preparing paper cables, above 11 kV and up to and including 33 kV, 4; preparing paper cables above 33 kV, 5. The revisions were to take effect as from the beginning of the first full pay period following 6th April. Where the rates already paid for these occupations are equivalent to the revised classifications now agreed no further increase is necessary.

Heavy Media Separation Plant Order

The Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., has received an order from the Silvermines Lead & Zinc Co., Ltd., Eire, to supply a heavy media separation plant. This equipment is intended to double the tonnage of lead/barytes ore to be treated without the need for further extension of the existing flotation plant. A 7ft diameter separatory cone will be employed, using ferro-silicon medium. All motors and starters will be manufactured by the G.E.C.

Lighting and Plant Growth

Light is one of the major factors controlling plant growth. By the appropriate use of artificial light greater control over the growth and development of plants is possible. It is a complex subject and in E.R.A. Report Ref. W/T31, "Artificial Lighting for Plant Growth," by A. E. Canham, M.Sc.(Eng.) (price 1s 6d) the effects of different light conditions are discussed. Applications of artificial light in research and commercial horticulture are also considered, together with the merits of different light sources for these purposes.

Newspaper Strike Inquiry

The dispute over the pay claims of about 700 maintenance engineers and electricians which had prevented the publication of daily newspapers in London since 25th March was considered last week at a Court of Inquiry under Sir John Forster, Q.C.

The case for the Electrical Trades Union was presented by Mr. F. Foulkes, general president. He referred to the "extremely difficult situation" in which they were placed by the Newspaper Proprietors' Association's insistence that, irrespective of the particular merits of the claim of the E.T.U., negotiations on wages and conditions could not take place until negotiations had been completed by the Association and the Printing and Kindred Trades Federation, and then only on the basis that the E.T.U. accepted the terms of settlement reached with the P.K.T.F. He contended that such an attitude ignored the special claims of differing categories of workpeople in the industry and precluded from consideration any claim for additional payments based on higher technical requirements, skill and responsibility that were often consequent upon the introduction of new methods of production.

The basic wage of day-work electricians in the industry in 1939 was £6 a week, said Mr. Foulkes. It was now £10 11s 6d. The union was claiming £13 10s which would represent a 125 per cent increase on the weekly rate paid in 1939 compared with a cost of living rise of 133 per cent.

For the Amalgamated Engineering Union, Mr. J. R. Scott said that if the union had been able to negotiate freely with the N.P.A. or be associated with the negotiations conducted by the P.K.T.F. the present position would not have arisen.

It was explained on behalf of the N.P.A. that the Association decided on a "global sum" and distributed it in accordance with "time honoured differentials" to the members of the thirteen unions employed by its members. The offer was usually made in the first place to the P.K.T.F., representing most of the unions and about 90 per cent of the workers employed by members of the N.P.A.

Mr. Charles Russell, Q.C., said it was a basic principle that no union should be granted preferential treatment over any other union. The maintenance unions claimed that their members' wages had fallen below the 1939 standard. The explanation was that throughout industry the highest percentage increases had been enjoyed by the lowest paid workers. The experience of the maintenance unions in the newspaper industry was precisely the same as that of skilled people in every industry.

Investment Allowance

The British Association of Machine Tool Merchants has addressed a memorandum to the Chancellor of the Exchequer in which it sets out a case for an adequate investment allowance for second-hand machinery which would assist the expansion of small and medium size businesses.

Castle Donington Power Station

We regret that in the abstract of the paper published in our last issue on Castle Donington power station, presented by Mr. J. T. Edwards before the Society of Engineers, we incorrectly stated that he was with the Central Electricity Authority. Mr. Edwards is a member of the staff of Freeman, Fox & Partners.

Alternator for Drill Boat

The National Gas & Oil Engine Co., Ltd., has supplied an alternator set for the first of a new type of Canadian drill boat. The vessel was built by George T. Davie & Sons, Lauzon, Quebec, to the order of the Department of Public Works, Ottawa. It will be used at Port-aux-Basques, Newfoundland, to dredge a channel for a new ferry from Sydney, Cape Breton Island, to Port-aux-Basques. For supplying power for the drills a National 150 kW set was ordered from Hall Engineering, the marine agents in Montreal of Brush Aboe (Canada), Ltd. The set comprises a National M4AA8, eight-cylinder diesel engine developing 262 b.h.p. at 1,200 r.p.m., and a flange-mounted 150 kW, 440 V alternator manufactured by the Brush Electrical Engineering Co., Ltd. The whole set is mounted with a radiator on a bedplate. The radiator fan is

driven from the forward end of the engine. The engine is started by compressed air from a Petter Reavell petrol engined compressor set. A 2½ kW diesel alternator set, manufactured by Petters, Ltd., supplies the electricity for lighting.

The Mexican Market

In a recent address to members of the Federation of British Industries, Mr. M. Field, the Federation's representative in Mexico, said that of Mexico's imports of £250 million annually, the United Kingdom at present supplied only about £6 million, and in spite of the fact that Mexico was a difficult market, a serious effort by British concerns could result in a doubling of this figure.

Speaking of heavy electrical equipment, Mr. Field said that only about 50 per cent of Mexico's population enjoyed the benefits of electricity and it would undoubtedly be part of the Mexican Government's policy for many years to come to expand the present generating potential and build more and more generating stations of all types. Equipment of this type had recently been supplied on a large scale by Continental firms and there was no reason why the United Kingdom should not be obtaining a good share of this business. The United States at present could not compete in price for this kind of equipment with the United Kingdom or other European countries and full advantage should be taken of this present situation.

Window Display Competition

So close were the two best displays in the national final of the British National Electrics, Ltd., window display competition, that the organizers decided to award a special runner-up prize of £20 in addition to the £50 awarded to the winner. Each of the competitors in the final had previously won a competition organized in their own Area Board and had been awarded a prize of £20. The winning display was by Huddersfield Service Centre, Yorkshire Electricity Board, and featured a humorous caricature of heavyweight boxers, the link being made with the outstanding points which make the B.N.E. C.90 cooker an easy winner. The runner-up was Chesterfield Service Centre, E.M.E.B., with a colourful display in a modern treatment. The members of the adjudicating panel were Messrs. O. Pawsey, N. Phillips, J. B. Omand, H. J. Riches, J. Sanders and W. S. Boone.

The winning display by Huddersfield Service Centre in the recent B.N.E. window display competition

English Electric Canadian Purchase

An important step in the investment and expansion in Canada of the English Electric group is indicated by an announcement made by Mr. C. D. Howe, Defence Production Minister, and Mr. H. B. Style, president, John Inglis Co., Ltd., and the English Electric Co. of Canada, Ltd., which states that the Canadian Government has sold to the English Electric Co. of England the Scarborough factory, near Toronto, comprising 14 acres of land, buildings having a floor area of 180,000 sq ft and related services. The title to Government owned machinery and equipment located in the factory remains vested in the Crown and the complete production facilities are to be maintained available for defence requirements of the country for a ten-year period.

The factory, which was built in 1952 by the John Inglis Co. for the Department of Defence Production and which has since then been run by that company for the Crown, will continue to be operated by the John Inglis Co. and the English Electric Co., in England, for the Royal Canadian Navy escort vessel programme. When the naval programme is completed the new Scarborough factory, together with the existing facilities at Toronto and St. Catherines, will substantially increase the capacity available to meet the needs of the expanding Canadian economy for the manufacture of heavy mechanical and electrical equipment. This, together with the great resources in engineering and scientific research of the group as a whole, will increase its participation in the basic development of large power and heavy industrial projects.

Transmitters for Holme Moss

The B.B.C. has placed a contract with Marconi's Wireless Telegraph Co., Ltd., for the supply, installation and setting to work of six 10 kW v.h.f. frequency-modulated transmitters to serve the North of England area. The order also calls for the provision of drive, phasing and monitoring equipment, and four combining units. Including this new order, a total of forty-six Marconi f.m. transmitters are at present under manufacture, or in process of installation for the B.B.C. The six transmitters for the North of England are to be sited at Holme Moss, and will feed into the slotted aerial array which forms an integral part of the existing 750ft television mast, in accordance with the B.B.C.'s plan for shared television/f.m. sites.

The transmitters will operate in parallel pairs, one pair handling the Home programme, another the Light and the remaining pair the Third programme. Each unit will therefore have an output power of 20 kW, which, in conjunction with the high-gain aerial, is estimated to produce an effective radiated power of 120 kW. It is anticipated that the new station may become operational in the latter half of 1956.

Australian Mine Order

The General Electric Co., Ltd., has received from its Australian associate, the British General Electric Co. (Pty.), Ltd., an order for an automatic electric winder for Mount Isa Mines, Ltd., to be installed in their Queensland, Australia, mine. The winder will be a double drum type having drums 16ft in diameter and will be driven through reduction gears by two 2,250 h.p. d.c. motors. The equipment is designed for a final duty of raising 12 tons of ore per wind by skips from a depth of 4,000ft, giving an output of 350 tons per hour. Automatic push-button control from twelve different levels will be provided, and the control scheme will incorporate control exciters operating in conjunction with a Ward-Leonard Ilgner set driven by a 3,350 h.p., 3·3 kV slipring motor. The contract includes the driver's control desk together with all the associated a.c. and d.c. switchgear and motor control gear and is valued at approximately £A200,000.

Electrical Plant Manufacture in India

Acting on a report submitted by Associated Electrical Industries (Gt. Britain) and Siemens (West Germany), the Government of India has decided to set up a heavy electrical equipment factory at an estimated cost of about Rs 200 million (£15 million). The factory will concentrate on transformers of 33 kV and above, hydraulic turbines and generators, generators for diesel sets and traction motors for railways. Details have not yet been worked out but it is understood that the consultants who drew up the preliminary project report will be associated with the new enterprise.

For the last three years India has been importing electrical goods from abroad to the extent of about £25 million per annum of which roughly a fifth or so constitute heavy electrical items. Almost all the heavy machinery for the river valley projects has come from Europe and the United States,

Japan being represented in such categories as switchgear, insulators and in one or two cases, such as at Tilaiya in the Damodar Valley, 2,000 kW turbine and generator sets. A trade delegation from Czechoslovakia has recently been reported to be negotiating with the Government for the supply of electrical equipment on very attractive terms, and their exhibition in Bombay displayed quite a number of possible export items including switchgear, insulators and turbo-generator sets.

Trades Register of London

The 1955 edition of "Trades Register of London" indicates that more and more companies are moving their head offices and showrooms, and often their factories, from East to West London, and numerous address alterations have had to be made among the classified trade sections. The move is attributed to the relaxation of building restrictions during the last year or so. New buildings are becoming increasingly available, and alterations and expansions to others have become possible. The Register, which is published by the Kemp's Group of Publishing Companies, 299-301, Gray's Inn Road, London, W.C.1, contains more than 50,000 classified names and addresses, including six thousand new ones. The price of the Register is £3 3s in Great Britain, £3 13s overseas, and pre-publication (prepayment) £2 2s.

Glass Manufacturing Amalgamation

Two glass manufacturing concerns, Stevens & Williams, Ltd. (Royal Brierley Crystal), and S. & W. (Lighting), Ltd. ("Sunglow" lighting glass), have been amalgamated. The two companies, although making different types of glass by different methods, have been closely associated in the past and have operated to a large extent under the same directorate. The combined company will carry the name of Stevens & Williams, Ltd., and the main board will be:—Mr. H. S. Williams-Thomas (chairman), Lt.-Col. R. S. Williams-Thomas (managing director), Mr. Howard Fletcher, Lt.-Col. W. H. Taylor, Mr. J. E. Driver and Major H. Ingram. The two factories will continue under the same management as before, the crystal works having executive directors in the persons of Mr. G. L. Hill (sales director) and Messrs. H. Whitworth and A. Hill (works directors); and the lighting section at Tipton, Mr. S. W. Kirby (sales director) and Dr. R. Halle (works director).

First Aid Competition

The Great Yarmouth First Aid Team won the men's section of the Central Electricity Ambulance Centre First Aid Competition held in London on 30th March. Awarded 297 points out of a possible 400, they were competing against twelve other teams who had won eliminating rounds in competitions held in their areas throughout the country.

The winners in the women's section were Swindon, who scored 316½ points out of a possible 400. The championship trophies were presented by Mr. J. Eccles, deputy chairman (operations), Central Electricity Authority. The members of the teams each received a plaque. On 17th November the men's team will represent the Central Electricity Ambulance Centre in the St. John Ambulance Association's competition for the Grand Prior's Trophy in London.

Mr. J. Eccles presenting awards for the Central Electricity Ambulance Centre's National First Aid Competition

Export Licensing Control

The Board of Trade has made the Export of Goods (Control) (Consolidation) Order, 1955 (S.I. 1955 No. 518), which incorporates for the convenience of exporters the 1954 Consolidation Order and subsequent amendments. No change is made in the law but certain simplifications have been introduced in the new Order. In the First Schedule, goods subject to export licensing control to all destinations are marked with the letter A. Goods not so marked are free from export licensing control to the British Commonwealth, the Irish Republic and the United States of America. The Second Schedule lists the destinations for which all goods are subject to export licensing control. Copies are obtainable from H.M. Stationery Office, price 1s.

Scottish Management Conference

The fourth Scottish Conference to be organized by the British Institute of Management will be held at Turnberry, Ayrshire, from 20th to 21st May. The theme of this year's conference is "New Techniques for Old," and speakers at the various sessions will emphasize how important it is for top management to keep abreast of new developments not only in production methods, but in maintenance, financial and personnel policies. Speakers will include Mr. B. B. Swann of Ferranti, Ltd., who will discuss electronic computation—its uses and implications for management, and Mr. T. H. Windibank, director of Crompton-Parkinson, Ltd. The conference fee will be £5 5s.

Trade Announcements

Burn & Orson Wright, Ltd., electrical wholesalers and engineers' merchants, have moved to Burley's Lane and Grafton Place, Leicester (telephone numbers unchanged). The new premises have double the floor space of the previous premises in Southgate Street.

Ferodo, Ltd., has transferred the sale and manufacture of "Ferobestos" technical plastics to its associated company, **J. W. Roberts, Ltd.,** who will set up, near Bolton, a new department devoted to the development of these plastics. Ferodo, Ltd., and J. W. Roberts, Ltd., are members of the Turner & Newall, Ltd., organization.

North London Exhibition

The North London Home-Lovers' Exhibition will be held from 20th to 30th April at the Alexandra Palace, N.22.

Lyons International Fair

Thirty-three countries will be represented at the Lyons International Fair being held from 16th to 25th April. Fifty-eight trade groups will be covered by the exhibits. More than sixty British firms are taking part and they include Arvin Electric, Ltd., Arrow Electric Switches, Ltd., J. A. Crabtree & Co., Ltd., Erie Resistor, Ltd., Standard Telephones & Cables, Ltd., Smiths English Clocks, Ltd., and Thorn Electrical Industries, Ltd.

Overseas Trade Fairs

An increasing number of British concerns are taking part in trade fairs overseas, and there is an even greater increase in the number of such opportunities becoming available. In an attempt to point out the pitfalls, to advise British companies on how to make the most of exhibiting overseas, and to set out the merits of some of the most notable trade fairs abroad, the Board of Trade has published a booklet for intending exhibitors. Drawing on the experience of several British manufacturers who have successfully shown their goods abroad, it deals with such subjects as the choice of fair, methods of exhibiting, costs, publicity and public relations. It is illustrated with pictures of trade fairs in Paris, Cologne, Hanover, Milan and New York. Among the sample budgets printed are those for small-scale participation at the Canadian International Trade Fair, 1954, for

£650 inclusive, and for a more elaborate display at the Milan Samples Fair, 1954, costing over £3,000. The booklet, "Trade Fairs Overseas," can be obtained from H.M. Stationery Office, price 1s.

Large Neon Signs

Erection of the large neon signs on the south-east face of B.O.A.C.'s new headquarters building at London Airport is nearing completion and tests are now taking place. The letters "B.O.A.C.," 9ft high and 31ft long, are fitted to both the outer counterweights on the south-east face and Speedbird signs, each 30ft long, are fitted to the two inner counterweights. The letters "B.O.A.C.," 5ft high, will later be added above each of the Speedbird signs, the whole being duplicated on the north-west face of the building. At the top of the north-east and south-west faces of the headquarters, 55ft above the ground, neon lettering will be placed later to spell out the words "British Overseas Airways Corporation" in full. The lettering has been manufactured and erected by Claude General Neon Lights, Ltd., and the electrical installation is being undertaken by T. Clarke & Co., Ltd.

E.C.G.D. Sheffield Office

The Export Credits Guarantee Department announces that its Sheffield office is now at Orchard Chambers, 27a, Church Street, Sheffield, 1 (telephone: Sheffield 29151).

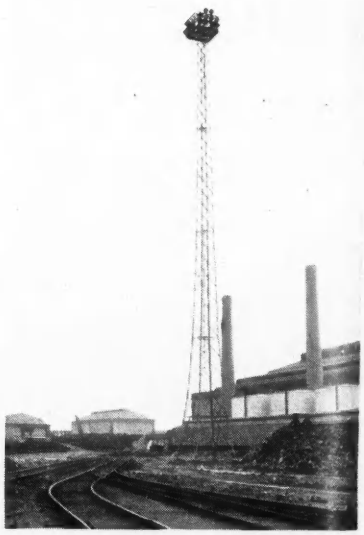
MODERN STEEL PLANT LIGHTING

THE new open hearth steel plant of Dorman Long (Steel), Ltd., at Lackenby provides several interesting examples of industrial lighting applications. In the main building which is 1,083ft long by 230ft wide the casting and charging bays are each illuminated by 50 G.E.C. circular high-bay reflectors housing alternately 1 kW "Osram" mercury lamps and 1·5 kW tungsten lamps. The fittings are mounted in a single row at a height of 95ft in the casting bay and 73ft in the charging bay, giving an average illumination of 6 lumens/sq ft with almost complete absence of shadow.

The combination of mercury and tungsten lamps gives a very agreeable warm light while still retaining a high lumen per watt ratio. The fittings used consist of an anodized aluminium reflector with vitreous enamel canopy and an annular ventilation opening which also allows some upward illumination. This vent provides convection air-flow over the reflector surface thus retarding the deposition of dirt.

Each railway grid on the Lackenby site is 1,200-1,800ft long by 300-500ft wide. It was decided that no posts, which could cause obstruction and which would be liable to damage, should be erected on the grids. It followed that light sources should have long throws and high power so that the least number of points could be used; this meant that the sources had to be as high as possible to reduce glare.

With these factors in mind, six 150ft lighting towers were erected, each capable of accommodating forty-eight 1 kW B.T.H. tungsten dual focus floodlights. The spacing between towers varies between 1,100ft and 1,400ft and the spacing to mounting height ratios are not more than 10:1. The illumination planned was 0·25 lumens/sq ft over the rail grids with up to 1·5 lumens/sq ft around the groups of railway switches at the end of the sidings. Readings have confirmed that the level of illumination is within close limits of the value planned. In average weather conditions it is possible to read a pencil-written address label on the side of a truck when the truck is 500ft from the nearest tower base.



Railway yard lighting tower

The charging bay at Lackenby Steelworks and (right) the railway yard at night

Engineering in Europe

Abstracts from Foreign Technical Journals

AN a.c.s.r. conductor for 230 kV, the core of which was insulated by a synthetic rubber sheath, 3 mm thick, was used for interesting experiments on the formation and thawing-off of ice coatings on overhead line conductors and on the possibility of preventing icing by current-heating of the steel core. The idea was to let the operating current be carried only by the steel core during the winter season which should be sufficient to prevent ice coating. The insulation must in this case be designed for a sustained temperature of 75 deg C, and for 100 deg C to be withstood for an hour.

The results of the tests carried through at air temperatures between −16 and +25 deg C (to determine the maximum temperatures of conductor and insulation) were very satisfactory as they showed the actual possibility of preventing ice coating, and also that the temperature of the rubber insulation could be limited to 75 deg C as a maximum, unless the air temperature went up to 30 deg C, and kept at this value for more than an hour. The results enable the power requirement and duration of the heating periods to be determined for a wide variety of weather conditions and the tests made it possible to collect details about the icing processes on h.v. lines.—"Icing Protection of Overhead Lines," K. Spaderna, *E.T.Z.(B)*, Vol. 6, No. 12, pp. 432-434, 21st December, 1954, in German.

Surge Diverter Testing

The permanent readiness for service of surge diverters is, if anything, even more important in the widespread power systems of the U.S.S.R. than in many other countries, owing to the high incidence of thunderstorms over a considerable part of the year. Because many substations are remote and difficult of access during the thundery season, the existing mobile h.v. test vans cannot be used everywhere for this purpose. The main danger to the serviceability of the diverters arises from moisture and dust penetrating into the sealed diverter casing, since this results in leakage currents and may upset the voltage distribution over the vilite discs and series resistances.

Two methods of "prophylactic" (i.e. non-destructive) testing are suggested, one of which consists in the measurement of the total resistance of a diverter after artificial wetting of the diverter elements by blowing steam into the diverters. A relation between leakage currents and breakdown voltage is then obtained by applying the rated breakdown voltage of the individual diverters to them and actually measuring the leakage currents and d.c. resistances in a certain voltage range. The relation between resistance and leakage current at the rated voltage is a fairly reliable criterion of the serviceability of the diverter, since the permissible value of the leakage current must not be appreciably exceeded. For larger diverters the measurement of the individual disc resistances is recommended.

The second method suggested is the measurement of the voltage distribution over the individual discs and shunt spark gaps by electrostatic kV-meter, this being possible without disconnecting the diverter from the system, using an instrument mounted on an insulating rod.—"Simplified Methods of Prophylactic Testing of Vilite Surge Diverters," D. V. Shishman, *Elekt. Stantsii*, No. 9, pp. 39-43, 1954, in Russian.

Selenium Rectifiers

The great advantages of selenium rectifiers are well known and new fields of application for this progressive type of rectifier are found fairly regularly. It is no longer true that selenium rectifiers are suitable only for a limited output range, but there are certain inherent characteristics of this type which have to be considered in extending its operating range. These refer particularly to the very important problem of the cooling of the plate system.

Natural air cooling is sufficient only up to ratings of about 10 kW and has to be replaced by forced air cooling above this limit. Yet owing to the fact that the heat loss may be as high as 15 per cent of the d.c. output, this amount of heat cannot be absorbed by the ambience in the case of larger plants, and a special ventilating system for the rectifier room becomes necessary. Also, forced air cooling introduces the danger of dust and other particles, possibly of a corrosive kind, penetrating into the plate systems, and obviously this danger increases with the air quantity required for cooling. The solution of immersing the plate systems in oil would therefore suggest itself, the more because it serves two purposes, viz. that of efficient cooling and of corrosion protection. Since the high overload capacity of selenium rectifiers is among their most notable virtues these rectifiers are preferably used for plants in which overloading is a frequent occurrence.

The article describes and shows a multitude of oil-cooled selenium rectifiers for various purposes (galvanizing, electrolysis, welding, mine railways, lifting magnets, etc.).—"Oil-Immersed Selenium Rectifiers," E. Schröter, *A.E.G. Mitt.*, Vol. 44, Nos. 3/4, pp. 131-135, March-April, 1954, in German.

Controlling Hydro-Electric Sets

The dynamic stability of long transmission lines supplied by large hydro-electric power stations is a difficult problem, complicated by the fact that the inertia constants of hydro generators are as a rule smaller than those of turbo-alternators, by the slow operation of turbine governors, particularly of low-head turbines, the inertia of the water masses to be controlled, and the danger of water hammer.

Since the normal control equipment of the water turbines is therefore unsuitable for intervention in the case of system faults, the occurrence of a short circuit in the system reduces the output of the hydro generator and sets up at its shaft a large accelerating torque, the effect of which is to increase the phase difference between generator e.m.f. and busbar, or system, voltage. The electrical braking torque set up in the generator after clearance of the short circuit is not strong enough to cancel out the accelerating torque so that the deviation between generator e.m.f. and busbar voltage still increases, with the danger of loss of synchronism.

A possible solution of the problem is the use of the

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

mechanical brake of the hydro generator for reducing the accelerating torque, all the more as it is usually operated by compressed air and controlled by a solenoid. The theoretical investigation as well as practical tests have shown that it is quite easy to convert the control system for automatic operation, that the braking power available is sufficient for the purpose and that the improvement of the dynamic stability so achieved is satisfactory.—" Improvement of the Dynamic Stability by Mechanical Braking of Hydro Generators," A. V. Bogoslovskii, *Elektrichestvo*, No. 12, pp. 45-50, 1954, in Russian.

Rotary Magnets

Rotary magnets are used in many types of electrical apparatus and instruments. Their particular suitability for a wide variety of purposes is due to the fact that their torque characteristic is very flexible and can be adapted to all kinds of patterns by a judicious design. Although the theory of these magnets is not unduly complex, it requires the arbitrary assumption of a good many fundamental parameters; also, the configuration of main and leakage fluxes is not exactly predictable. These represent the main difficulties in the design of such magnets. It has therefore become usual to use a semi-empirical method: to have a model made and tested, the dimensions of which have been determined by an approximative overall calculation. The desired effects are then achieved by corrective alterations carried out, if necessary, in successive steps, on this model. Now it is evident that this method is wasteful of time and laborious, since it would have to be repeated for every size or rating of a series of otherwise similar magnets. The problem arises whether laws of similitude and scale factors exist which would permit the transfer of satisfactory results from one size of magnet to others, so that a series of magnet ratings could be based on the experimental development of one size. The author shows that these laws actually exist and that the main parameters can be determined for a fictitious " unit magnet " and then transferred to any size of geometrically similar magnet, the torque characteristic of which will be similar to that determined for the unit magnet. The theory of similitude for a.c. and d.c. rotary magnets is derived in the article.—" Similar Rotary Magnets," H. Lenk, *Elin-Z.*, Vol. 6, No. 4, pp. 193-199, December, 1954, in German.

Communication Cables

The successive stages in the development of star-quad cables for communication purposes are represented by their first introduction, by the utilization of the phantom circuits and by the introduction of carrier-frequency quads. A further step may be seen in the combination of low and carrier frequency quads in the same cable, this being particularly suitable for railway service communications, where short distances are served by the l.v. quads, also utilizing the phantom circuits, and long distances by the carrier-wave quads. The cable works with a 12-channel system in separate two-wire arrangement, the two transmission directions using different frequency bands (one the 6-54 kc/s band; the other the band from 60-108 kc/s). The band width of 300-3,400 c/s corresponds to modern requirements. The attenuation of 6·5 Neper on which the design is based makes the utilizable distance between amplifiers 31 km. The use of the A.E.G. type of carrier frequency star-quads increases the wave impedance as compared with a normal, unloaded cable, to 175 ohms. The cross-talk attenuation is high and the service attenuation low, which makes it particularly suitable for carrier-wave operation. The high economic utilization of the paper insulation results in the remarkably small line diameter of 1·2 mm. The carrier-frequency quads form the central core of the cable and are surrounded by one or two layers of l.f. quads.—" Combined Communication Cable for Low and Carrier Frequencies of the German Federal Railways," G. Herzig, *A.E.G. Mitt.*, Vol. 44, No. 11/12, pp. 408-417, November-December, 1954, in German.

Control Amplifiers

A comparative investigation of the special requirements for amplifiers in rolling-mill drives and analysis of the various types of amplifiers available for this purpose is presented. Amplidyne and metadyne, together with magnetic amplifiers, form the group of field-controlled amplifiers which have been used in rolling-mill drives increasingly and with satisfactory results in recent years. Since the conditions in different cases may differ very substantially, improvements are required and possible by using several amplifying stages which may, or may not consist of amplifiers of different types. Considerations of speed, frequency, output and harmonics will determine the number of stages and types of amplifiers most appropriate for the given case, and also the kinds and numbers of secondary elements and auxiliaries. A second group of amplifiers, collectively known as grid-controlled amplifiers and comprising electronic and ionic devices, have recently entered the field of rolling-mill control amplification. All these amplifiers may work satisfactorily if they are used for the control method for which they are most suitable, e.g., metadynes as high-speed exciters, amplidynes as proportional governors in Leonard drives, magnetic amplifiers as proportional regulators in constant-current circuits, electronic amplifiers as proportional voltage regulators for Leonard generators, and mercury rectifiers as switch elements in constant-current circuits.—" Amplifiers for the Control of Rolling-Mill Drives," E. Nagel, *A.E.G. Mitt.*, Vol. 44, No. 11/12, pp. 438-446, 1954, in German.

Insulator Flashover

Long experience has taught that dry extraneous layers do not in general appreciably reduce the flashover strength of an h.v. insulator. Only when these deposits become wet may the surface resistance be lowered to an extent rendering flashovers possible. This danger arises particularly during long periods of fog, rain being of much less consequence. The insulator design and the determination of the co-ordination of insulation levels, hitherto merely based on wet flashover voltage tests, must therefore also consider the dangers associated with wet deposits on the insulators. Improved insulation designs cannot be based on the unrealistic testing methods so far applied, since the flashover and impulse flashover tests stipulated in most regulations cannot furnish information on the performance of dirty and wet insulators in foggy weather at the operating voltage. They must therefore be replaced by tests in simulated service conditions. That this is possible is proved by the author's investigations, and those of other workers, which show clearly that flashovers at the operating voltage are a result of particular patterns of alternating wet and dry zones on the insulator surface, resulting in more or less unfavourable distributions of leakage path and flashover resistances and voltages, respectively. Although much valuable work has been done in this field in recent years, much more is required and the stage has been reached at which the problem can be successfully analysed only by separate investigations of its various aspects, such as the influence of the nature of the deposits, their quantity and distribution, initial conductivity, moisture absorption, etc. —" Flashover of Extraneous Layers on Insulators at the Operating Voltage," G. Reverey, *E.T.Z.(A)*, Vol. 76, No. 1, pp. 36-42, 1st January, 1955, in German.

ELECTRICITY IN COAL MINING

4.—Electric Winding in Mine Shafts

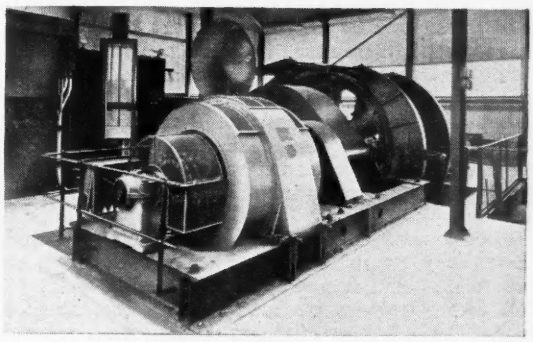
By G. CUTTLE*

A LARGE number of mine shafts are still served by steam engine driven winders ranging from 25 to 100 years old. In the days when they were installed, having regard to power supply restrictions and to the low cost of the inferior fuels generally burned on colliery boilers, they could be considered reasonably efficient, particularly where the exhaust steam was utilized in mixed pressure turbo-generator sets for providing electricity supplies to collieries. In the light of modern developments, however, the low pressure steam winder can be considered obsolete; it arrests progress in efficient power utilization. Electrification of our mine shafts is progressing as fast as manufacturing capacity and availability of generating capacity permits, but priority must be given to new mines and to major reconstruction schemes, where new winding plant is necessary to raise the increased outputs planned, and to those winders where, by virtue of their age and condition, replacement is essential to the continued working of the colliery.

With the introduction of electric winding comes the opportunity of providing a degree of control and supervisory protection not possible on the steam winder; of achieving a higher standard of safety; and of easing the task of the winding-engineman which, taking into account the varying conditions of raising and lowering loads met with during a shift and the degree of concentration necessary, can be very arduous and exacting.

Types of Winder

Electric winders so far installed in this country have generally been of the drum type on which the ropes to which the conveyances are attached are coiled on and off the drum as they are raised and lowered. These drums are either of the parallel or the cylindro-conical type, the latter providing for the equalization of ascending and descending torques, thus limiting the winding power peaks.



Electric winders so far installed in this country are generally of the drum type

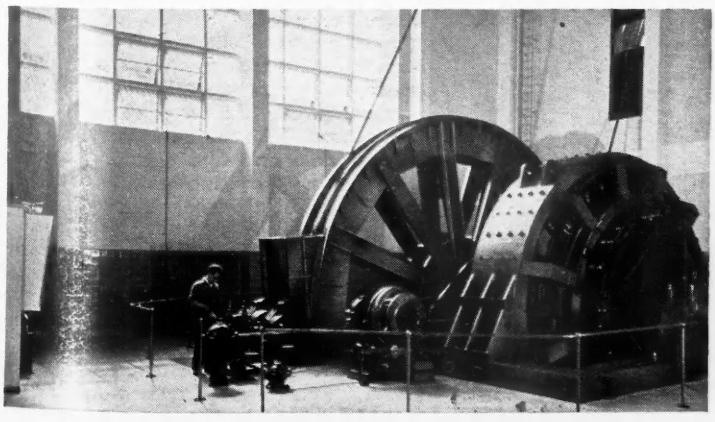
Where the winding duty is to remain substantially the same and the drum brakes, shaft and bearings of a steam winder are in good condition, it can often be converted to electric drive. This involves removing the cylinders and cranks, and coupling the drum shaft, usually through a reduction gear, to an electric motor and modifying the brake gear for either air or oil operation.

At some collieries electrification of the winders is not always so straightforward as may be expected because steam winding plant was often designed for a duty cycle and maximum winding speed which would be completely uneconomical for electric winding. In these cases a complete revision of the winding arrangements, payloads, etc., often involving changes to the mine transportation system, has to be undertaken at the same time.

Since nationalization of the coal industry there has been a tendency at shafts where larger outputs are to be wound from great depths to adopt the Koepe system of winding, as generally used on the Continent. With this system the rope is not attached to the drum, but runs in a friction groove on the winder pulley, the drive being dependent on the friction between the rope and the groove. This type of winder can be mounted either in a tower directly above the shaft or on the ground at the side of the shaft.

A development which will have a far reaching effect on winding technique is the multi-rope friction winder. This winder operates on the Koepe principle, but instead of a single rope, two or more ropes—usually four—are used. These pass over a drum fitted with friction grooves and are attached to two conveyances or to a single conveyance and counterweight, balance ropes being used to equalize the system. The multi-rope friction winder has important advantages over drum winders and single rope Koepe winders, both from the point of view of safety and reduction in winder and installation costs. In so far as the electrical equipment is concerned, the reduction in drum diameter made possible by the use of multi-ropes results in: (a) A reduction in size of the motor; for the same winding speed the drum must move faster and, hence, a higher

* Mr. Cuttle is with the National Coal Board.



The Koepe winder can be mounted either in a tower directly above the shaft or, as shown above, on the ground at the side of the shaft

speed motor can be used; (b) a reduction in the torque to be transmitted by the motor and also in the inertia of the rotating parts, resulting in a reduction in motor h.p.

In the future new electric winders are likely to be generally of the tower mounted multi-rope friction type, except where special circumstances—e.g., the possibility of converting existing steam-engine drives to electric drives and the possibility of utilizing existing headgears or winder houses—outweigh or offset the advantages otherwise to be gained.

Electric winders are driven either by s.r. induction motors with variable rotor resistance or by d.c. motors with Ward-Leonard control. Where on a.c. winders the duty cycle requires appreciable braking to be applied, the control can be facilitated, and often the power consumption improved, by the installation of dynamic braking. In principle, when dynamic braking is applied the stator of the motor is disconnected from the supply by the operation of contactors and is connected to either a variable d.c. or a low frequency a.c. excitation supply, the rotor remaining connected to the controller. Under braking conditions the winder motor is driven by the overhauling load, and in effect becomes an alternator supplying as a load the controller resistance in the rotor circuit. By suitably regulating this in conjunction with the excitation a controlled braking characteristic can be obtained. Although a.c. winders have been developed up to about 4,500 h.p. for use in South Africa, their use in this country has generally been restricted, mainly by power supply considerations, to approximately 2,500 h.p. Even where Ward-Leonard m.g. control sets have been installed it has sometimes been necessary to provide flywheel equalization on the sets to limit the peaks on the power supply. It is a common fallacy that the fitting of a flywheel will reduce the maximum demand, whereas in fact the opposite is the case. Flywheels are expensive and uneconomical and, to-day, in view of the increasing supply capacity and change in winding technique, i.e., the introduction of friction winding, the use of balance ropes and the limitation of winding speeds and accelerations, there should be no further need for their use.

Control and Protection

The operation of the winder is controlled by a code of bell signals. Those from underground are given by the onsetter, whose duty it is to control the loading or unloading of the conveyances, and are transmitted to the "banksman" who has a similar duty at the surface, and to the winding-engineman who must await an operative signal from the banksman before starting to wind. A visual indicating panel is provided for the engineman to indicate the nature and source of all signals. The position of the conveyances in the shaft is indicated on a depth indicator, but in the final landing of the conveyances the engineman works to a mark on the rope or winder drum.

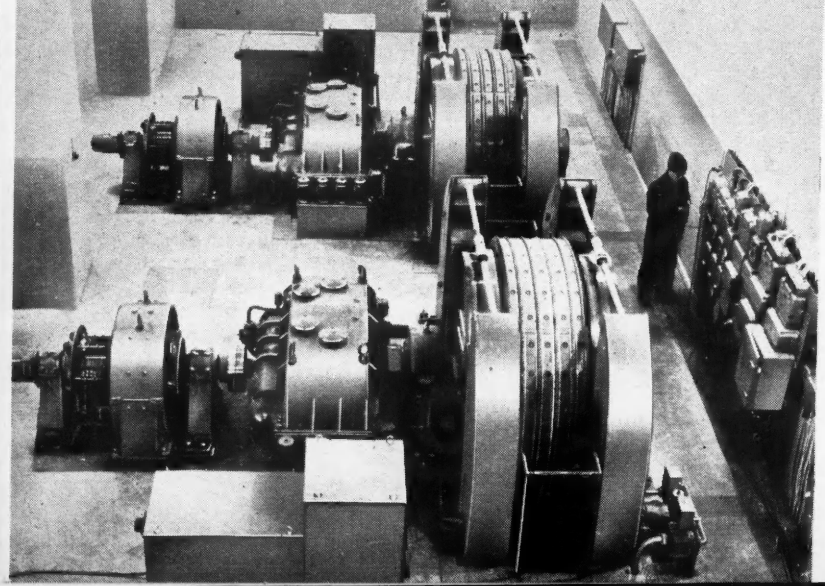
All winders used for raising and lowering persons which are designed to operate at speeds in excess of 12ft/sec must be fitted with a controller which will prevent the cages being landed on the pit bottom or other fixed landing at a speed exceeding 5ft/sec when men are being transported. In the case of friction winders, where the cages are not put down on any fixed landing, this permitted landing speed may be increased to 12ft/sec. These speeds may be increased for coal winding and are usually related to the overwind distance in the headgear. This controller usually takes the form of a speed governor which "shadows" the wind and is so arranged that, should the prescribed speed at any point in the wind be exceeded by more than 15 per cent, a switch connected in the winder safety circuit is opened; this causes the power to be cut off from the motor and the emergency brake to be applied. During the retardation period, the tripping speeds of the automatic contrivance must be adjusted to take account of the time delay in the application of the brake after the trip takes place and the possibility of the winder accelerating due to a descending load or to application of power in the wrong direction during this interval. There are different settings for men and mineral winding: men cannot be wound until a signal lamp at the landing place clearly indicates that the automatic contrivance is properly set. Protective relays and overwind switches are also connected in the safety circuit.

The driver must so judge and control the speed of the winder that he winds within the setting of the controller. Owing to the wide variation in speed which can be obtained on conventional a.c. winders for a given position of the driver's control lever, according to the nature of the load and whether it is ascending or descending, considerable skill is required of the driver if he is constantly to maintain an optimum winding cycle without tripping out. Ward-Leonard control simplifies his task, since the speed for a given position of the control lever is less affected by variations in winding conditions, but even with this type of control there can be appreciable speed errors and it is seldom that the driver can follow the cam gear with descending load without overspeeding.

The development of rotary and static amplifiers with high orders of amplification has had a far-reaching effect on winder control technique. By adopting the principle of "electrical follow-up," now commonly called "closed loop control," the system is being applied to provide speed/load compensation, control of torque and rate of change of speed characteristics, such that a constant speed cycle as a function of the position of the conveyance in the shaft is obtained irrespective of the load and the direction of wind.

In principle, the method of application is shown in Fig. 1. A voltage V_1, proportional to the winder speed, is obtained from a tachogenerator or other means and compared with a reference voltage V_2 adjusted to be proportional to the speed required at any point in the wind. The potential difference between them V_e, which is proportional to speed error, is amplified and used to actuate the control equipment to correct the speed to that required and, hence, tends to reduce the error to zero.

In the future new electric winders are likely to be generally of the tower mounted multi-rope friction type



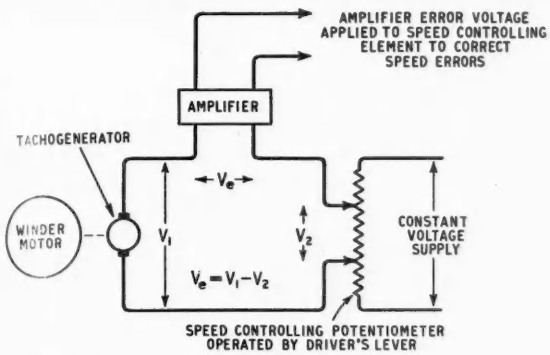


Fig. 1.—The "closed loop control" system provides characteristics suchthat a constant speed cycle is obtained irrespective of the load and the direction of the wind

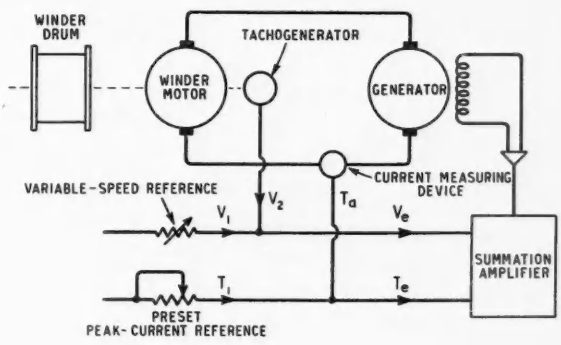


Fig. 2.—The application of "closed loop control" to the Ward-Leonard system

In a similar way, through the medium of the amplifying device and suitable discrimination, limitation of torque and rate of change of speed is obtained.

A typical arrangement of the application of closed loop control to the Ward-Leonard system is depicted in Fig. 2. A signal V_2, proportional to the speed of the winder, is obtained from a tachogenerator or by other means and compared with a signal V_1 obtained from a speed control reference which is controlled by the driver's lever, cam gear or contactor, so as to be proportional to the speed required. Under stable conditions V_e, the difference between them, will be small, and just sufficient when amplified to maintain the generator field. Any change in the relationship between actual and prescribed speed results in an increase in the error signal V_e which, when amplified, adjusts the field of the generator to correct the change.

To provide torque control a signal T_2, proportional to armature current, is compared with a reference T_1 pre-set to be proportional to the maximum permissible peak current. So long as this is not exceeded, the passing of an error signal into the amplifier is prevented, but immediately it is exceeded an error signal T_e, proportional to excess current, is fed into the amplifier to limit the build-up of the generator field and, thus, the torque. In a similar way, limitation of rate of change of speed is obtained.

Applied to a.c. winders, the amplified "error" voltage is used to control the automatic operation of the liquid controller or contactor controlled motor resistances and the application of dynamic or mechanical braking if required to maintain adherence to the prescribed speed cycle. The mechanical difficulties of obtaining a sufficiently rapid response in large liquid controllers and those of housing and dissipating the heat in fixed resistances, limit for the time being the practical application of automatic control of a.c. winders to about 2,500 h.p. rating and to skip and single-deck cage installations in which no deck changing operation is involved.

It is fortunate that these developments in control technique have come to fruition at the same time as multi-rope winding, because the combination of the two enables an entirely new approach to be made to the winding problem. For single level winding the practice will generally be to continue the winding of two conveyances in balance, but where multi-level winding is to be catered for, the single cage and counterweight system, as used on lifts, will be adopted. To obtain an equivalent output at the same winding speed with the single cage and counterweight system, the payload must be double that required for two cages and hitherto its use has been limited by payload restrictions imposed by single ropes. Normally, to obtain the most economical motor size the counterweight is arranged to be equal to the weight of the cage and tubs, plus half the load, but it is necessary to check that raising a counterweight against an empty cage is within the capacity of the motor and the brakes.

The accuracy which can be obtained with closed loop control, coupled with the balanced characteristic of the friction winder system, makes possible the introduction of push-button operation of the winder from the shaft landing places or from the cage. Owing to statutory requirements automatic winding may, for the time being, be restricted to mineral winding, but once this has proved satisfactory no doubt push-button control for persons will follow.

It is preferable with automatic control for the winding characteristics to be so arranged that for the normal duty the horse-power/time diagram is positive throughout the wind as shown in Fig. 3. This can often be achieved by suitably selecting the payload and winding speed.

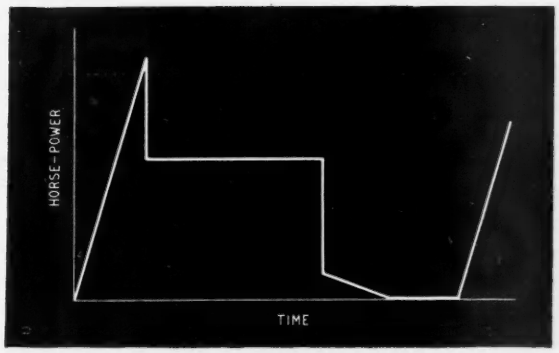


Fig. 3.—It is preferable with automatic control for the winding characteristics to be such that horse-power/time diagram is positive throughout the wind

The introduction of push-button operation simplifies signalling and winder control. The shaft gates and cage loading equipment can be interlocked with the winder starting circuits and close adherence to the prescribed winding cycle is enforced with the result that winding is made as foolproof as possible. The more constant winding cycle obtained results in a greater output than can continuously be achieved by manual control. Thus, electrification is making an ever increasing contribution to the safe and efficient operation of our mine shafts.

PARLIAMENTARY REPORT

Select Committee Approves North Wales Bill

At the resumed sitting of the House of Lords Select Committee which considered the North Wales Hydro-Electric Power Bill, by which the Central Electricity Authority seeks powers to proceed with the Blaenau Festiniog pumped storage and the Rheidol hydro-electric schemes, the final submission of counsel representing amenity interests was heard and certain supplementary evidence taken.

Mr. A. R. Cooper, controller of the North West, Merseyside and North Wales Division, C.E.A., had stated that the two schemes should be completed by 1964. Mr. C. T. Wolley (Freeman, Fox & Partners) gave the cost of the Festiniog scheme as £10,815,000, with a capacity of 300 MW and an annual output of 300 million kWh; the figures for the Rheidol scheme were: cost £5,178,000, capacity 49 MW, and annual output 87½ million kWh. The annual saving in production costs at Festiniog, compared with a steam station, would be £216,000 a year.

Later the chairman, Lord Terrington, announced that the Committee had decided to approve the Bill, subject to the inclusion of certain amendments which had been put forward by organizations anxious to preserve the natural amenities of the two mountain areas, and amendments which had been agreed between the C.E.A. and objectors during the proceedings. The amendments included one providing that the pipeline connection between the upper reservoir in the Festiniog scheme and the proposed Afon Ystradau reception reservoir should be underground or replaced by a tunnel, and that the proposed aqueduct between Trefeirig and Cwm Rheidol (Rheidol scheme) should also be replaced by a tunnel.

The Committee rejected the amendment which the company owning the Festiniog Railway had put forward. This provided that the C.E.A. should pay the cost of the diversion of the line at the point where it would be submerged for a part of its length by the proposed Afon Ystradau reservoir. It had been estimated that the cost would be about £120,000. The chairman said that the Committee regretted having to reject the amendment but did so on account of the cost involved.

The Bill will now go before the Lord Chairman's Committee for a number of minor points to be dealt with and it will later come before the House of Lords for its third reading.

Non-Industrial Welfare

Bad lighting in many shops and offices and the lack of safeguards in the operation of farm machinery were referred to by several M.P.s during the debate on the Non-Industrial Employment Bill, which was given a second reading by the House of Commons. The Bill, which was introduced by Mr. Harold Davies, seeks to make statutory provisions relating to the health, welfare and safety of people employed in places other than those regulated by the Factories Acts and the Mines and Quarries Act. It was given a second reading in spite of the fact that Mr. Heathcoat Amory, the Minister of Agriculture, had said that the subject was much too wide and complex to be dealt with effectively in a Private Member's Bill. Nevertheless, the Government agreed entirely with the Bill's objectives and intended to introduce a Bill as soon as Parliamentary time could be found for it.

Introducing the Bill, Mr. Davies said that there were 12 million people in non-industrial employment who were unprotected by legislation and the rate of accidents was increasing because of the greater mechanization of modern life. He said that many examples could be given of life in dark basement offices, workrooms, and even banks. His Bill laid down minimum standards of space, light and warmth.

Mr. E. G. Gooch, a former president of the National Union of Agricultural Workers, said that there had been an average of 122 deaths yearly from accidents on farms between 1949 and 1952. One half of all these deaths resulted from accidents involving machinery or from electrocution. Among things frequently responsible were power take-off shafts, chain, belt and gear drives, circular saws, stationary engines and electrical equipment. He and his union had been demanding legislation to protect the workers for thirty years, but nothing had been done.

The Bill will now go to a Standing Committee for detailed examination.

Transatlantic Telephone Cable

Asked by Mr. Charles Ian Orr-Ewing what progress had been made in the arrangements for manufacturing the transatlantic telephone cable, the Assistant Postmaster-General (Mr. Gammans) said that manufacture of both cable and repeaters had started on both sides of the Atlantic. Practically all the cable itself would be made in the United Kingdom. On account of rising costs on both sides of the Atlantic but more particularly in America, the total cost of the project might prove to be £15 million instead of £12½ million as was forecast in December, 1953. At this increased figure the value of the equipment, etc., manufactured in America would now exceed that from the United Kingdom and this country might have to make some contribution in dollars.

Radio Apparatus and Electrical Machinery Exports

Mr. Eric Johnson asked the President of the Board of Trade what was the value of the exports of radio and television equipment and electrical machinery from the United Kingdom to India, Japan, the dollar area and the rest of the world, respectively, in the years 1951, 1952, 1953 and 1954.

Mr. Low circulated the following answer in table form:—

	1951	1952	1953	1954
	£000	£000	£000	£000
Radio and television equipment*				
India	2,018	2,203	1,485	1,544
Japan	50	163	456	492
Dollar area ...	1,288	1,759	2,003	2,978
Rest of world	17,596	18,871	19,313	20,978
Total ...	20,952	22,995	23,256	25,992
Electrical machinery:†				
India	5,332	5,770	7,435	6,330
Japan	23	30	59	67
Dollar area ...	4,063	5,079	5,907	5,633
Rest of world	42,039	50,972	46,874	46,957
Total ...	51,457	61,850	60,275	58,987

* Including valves.
† Excluding electrical apparatus and appliances.

Monopolies and Restrictive Practices

Mr. George Darling asked the President of the Board of Trade whether, in view of the fact that, following on the report of the Monopolies Commission, the electric lamp manufacturers had given him an undertaking to revoke their trading ban on retailers who offered deferred dividends on sales, he would seek similar undertakings from all others who resorted to this ban.

Mr. Henry Strauss, Parliamentary Secretary, Board of Trade, said the undertaking followed the report of the Monopolies Commission into the supply of electric lamps. The Commission was now considering the general effect of such practices on the public interest, and the Government awaited its report.

Mr. Darling asked whether it was necessary to wait for the reports if the President of the Board of Trade could do a useful job of work by approaching the manufacturers, other than the electric lamp makers, who resorted to this practice.

Mr. Strauss said that the Commission's recommendation on the supply of particular goods did not enable action to be taken with regard to goods that the Commission had not considered, but the present examination which it was making under Section 15 of the Act might deal with the practice generally.

Transatlantic Telephone Cable

Details of the Newfoundland Land Link

THE transatlantic telephone cable project announced some time ago and described in an I.E.E. paper last November, has advanced a stage further with the dispatch by W. T. Henley's Telegraph Works Co., Ltd., last week of 45 miles of overland cable for the Newfoundland end. The order was received in May, 1954, for this length, which runs from Clarenville, the western ocean terminal in Newfoundland, to Terrenceville, on the other side of the country. At the same time an order was received for 9 miles of similar cable in two lengths but more heavily armoured. Manufacture has been carried out in conjunction with an associated company, Southern United Telephone Cables, Ltd. It will be recalled that the complete cable will run from Oban in Scotland and will provide thirty-six telephone circuits.

The shipment last week consisted of 93 drums which will be unloaded at St. John's, Newfoundland, and taken to site by tractor-hauled trailers. The two heavily armoured lengths of 5·7 and 3·3 nautical miles will be shipped directly aboard H.M.T.S. *Monarch* at Dagenham dock and will be laid across the south-western arm to Queen's Cove and at Pipers Hole River. The complete cable from Clarenville to Terrenceville is to be laid this summer.

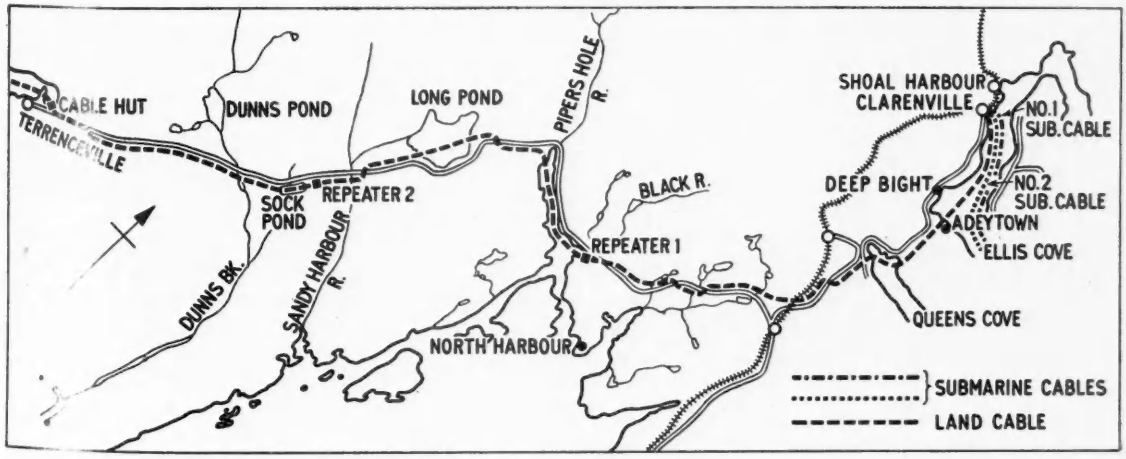
The route between these two places comprises sections where the cable will be laid approximately 30in deep in a trench and other parts where the cable will be laid in rivers and inlets along the route to reduce the excavation work. Where the cable is laid in this way it is more heavily armoured as a safeguard against the heavier mechanical strains to which it may be subjected. Generally, the terrain through which the land cable is to be laid varies from hard rock, through ground containing boulders of various sizes, to bog. Many parts of the route are covered with a thick tangle of bushes and small trees. In the cable-laying operations an advance gang will make a path through this scrub and blast the trench where solid rock occurs. A bulldozer will follow to clear the trench route ready for the trenching machine which is in the form of a mechanical shovel working backwards, picking up the earth and depositing it at the side of the trench. The drums of cable will be mounted on a tracked trailer which will be drawn by a tractor as the cable is paid off into the trench. A bulldozer will follow behind, backfilling the trench.

From Clarenville, the shore end of the submarine cable will run along an inlet of the sea to Adeytown where, at a point about 700 yd from the shore, it will be connected to a piece of one of the lengths of heavily armoured land cable and from this point normal land cable will run for about 5,000 yd to the edge of the south-western arm at Hillview. The *Monarch* will lay 4,000 yd of the same type of cable across this inlet to Queen's Cove. For the next 25,000 yd of the route normal land cable will be laid, that is, up to the first repeater position. At a point 4,000 yd beyond, the main length of the heavily armoured cable will be laid by barge and tug along the bed of the Pipers Hole River for a distance of some 11,000 yd. Another 25,000 yd run of land cable crossing several lakes or "ponds" leads to the second repeater position and a further 27,000 yd beyond this point completes the land route. The cable terminates in the Terrenceville cable hut where it joins up with the submarine cable to Sydney Mines in Nova Scotia.

Construction of the Land Cable

The centre conductor of the Newfoundland cable is an annealed copper wire 0·1318in diameter lapped with three 0·0145in thick annealed copper tapes bringing the overall diameter of the conductor to 0·160in. Over this conductor a covering of polythene is extruded in a single operation to a diameter of 0·620in. Over the insulated core six annealed copper tapes 0·016in thick are laid over which a 0·003in annealed copper tape and then a rubber-bitumen-wax tape are laid. Up to this stage the land cable has the same construction as the submarine cable. The purpose of the 0·003 copper tape on the latter cable is to protect the insulation against the teredo worm. This tape is retained in the land cable to preserve uniformity of the electrical characteristics.

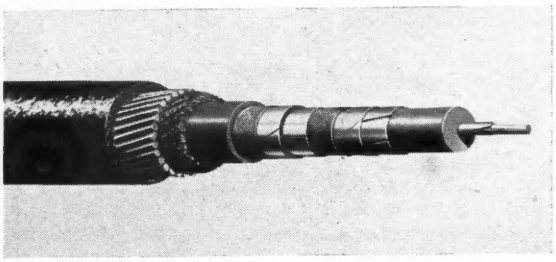
The Newfoundland cable may be subject to electrical interference from lightning, aurora borealis, electric power



The cable route across Newfoundland

networks, and radio. As a protection against lightning, wires will be laid above the cable in the trench to reduce the effects of a direct stroke or an induced voltage. As a protection against interference from other sources, one longitudinal and four spirally wound 0·006in thick soft iron tapes are applied to the core over which a rubber-bitumen-wax tape is lapped. To protect the soft iron tapes from rusting a polythene sheath 0·09in thick is extruded over the screened core.

The final stage of the cable construction is the armouring process in which a bedding consisting of two layers of tanned jute having opposite lays is first applied over the



Sample of the normal land-line cable

polythene sheathed core. Two kinds of armouring are employed. The normal type for the cable buried in a trench consists of 0·128in diameter galvanized steel wire. Where the cable is to be laid at the shore landings, across inlets, and along the river bed, a much heavier armouring is applied consisting of 0·276in diameter galvanized steel wires. Both types of armour are finished by an overall serving of two layers of tanned jute yarn with bitumen compound and finally whitewashed. The overall diameter of the normally armoured cable is 1·75in while that of the heavily armoured type is 2·1in.

Cable Characteristics

The electrical characteristics of the cable have to be maintained with the utmost uniformity so that the repeaters can exactly compensate the attenuation in all the cable circuits. The first step in this direction was the application of rigorous tests to ensure that all materials used complied with the exacting purchasing specifications.

At every stage of manufacture dimensions were carefully checked, especially the diameters of both the conductor and the polythene insulation which had to be maintained within very close limits at all times to ensure a high degree of uniformity in the electrical characteristics of the complete cable. Mechanical, magnetic, and electrical control tests were applied to verify close conformity with the specified characteristics. Each completed length of cable was wound on its steel drum and immersed in water for several hours so that the final tests could be made at a known temperature.

Conductor resistance, capacitance, and insulation resistance were first measured, followed by a high-voltage test of the insulation. To check the uniformity of the cable pulse-echo tests were applied, irregularities along the length being indicated by a cathode-ray oscilloscope. This test also determined the cable impedance. The irregularities must be small as the reflections they cause, in conjunction with the repeaters, may lead to degradation of the speech qualities of the cable.

The cable has been designed to transmit signals over a frequency band from 20 to 552 kc/sec and attenuation measurements have been carried out over the working frequency ranges. To determine the characteristics of repeater sections, a number of lengths of complete cable have been jointed together and measurements made over the whole length to verify the cable characteristics and to see that they can be effectively compensated by the equalizers and repeaters.

The cable crossing Newfoundland will have two repeaters. These will be laid in the ground, although they are of the same type as those which will be used for the submarine cable linking Terrenceville and Sydney Mines. The repeaters will amplify speech in both directions, the directional discrimination being secured by electrical filters responding to frequencies in the range 20-260 kc/sec in the direction Terrenceville to Clarenville and 312-552 kc/sec in the reverse direction. The electrical equipment of the repeater is contained in a nitrogen-filled inner chamber which is separated by brazed-in bulkheads from the pressure-resisting outer housings. The cable is taken through watertight glands into the repeater chamber and the cable armouring is secured in clamps in the outer housings. Each repeater is provided with two 60ft tail cables which will be jointed to the land cable.

Materials for Valves

OPENING a discussion before the Radio Section of the Institution of Electrical Engineers, Dr. R. O. Jenkins referred to the unlikelihood of any revolution in valve making through a new cathode. Attention, he said, was being centred on oxide-coated cathodes for receiving valves and for small transmitting valves, thoriated tungsten for transmitters, and special cathodes, such as the various forms of barium dispenser cathode, which were still used only in the experimental field.

Oxide cathodes in this country consisted of an alkaline-earth layer on a core of "o" nickel which had a low sulphur content and about 0·10 per cent magnesium as a reducing agent; this construction avoided interface troubles experienced in the U.S.A. with nickel of high silicon content. In long-life valves, cathode nickel might be made by powder metallurgy that was almost free of silicon, using tungsten as a reducing agent and for imparting mechanical strength, plus possibly a small amount of aluminium or magnesium.

Nickel alloy was unsuitable for filament currents below 100 milliamps; tungsten gave complete freedom from breakage. Alumina-doped tungsten probably made the best heater for indirectly heated valves, but rhenium might prove the best material. Brittleness was a defect of thoriated-tungsten cathodes.

Grids in receiving valves were usually of molybdenum tungsten or 5 per cent manganese nickel alloy wire; chrome copper gave the best compromise of strength and good conductivity for their support rods. For winding wire molybdenum was expensive and brittle and, if it became oxidized, could poison oxide cathodes, while 5 per cent manganese nickel was often insufficiently strong. A high-temperature nickel alloy, if it became available, would ease the situation. Tungsten was likely to be the only suitable material for grid wires of less than one inch diameter.

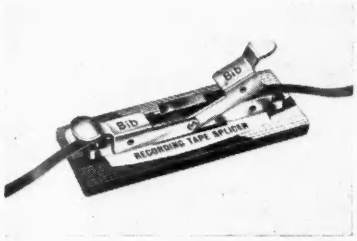
Transmitting valve grids generally used molybdenum, sometimes coated with platinum for grid-emission suppression; but better surface finishing and ductility were needed. Aluminium-coated iron for the anodes of receiving valves was cheap and had a high thermal emissivity without pre-treatment during processing, but it was unsuitable for close-clearance rectifiers owing to gas content, so that carbonized nickel must be used.

Anodes for glass transmitting valves were usually of molybdenum. Tantalum, which acted as a getter, would be desirable, but its cost usually precluded its use. Later speakers held that even the low silicon content of "o" nickel made it unsuitable for cathode cores and drew attention to the merits of a 40 per cent tungsten-nickel alloy. It was also said that nitro-cellulose as a binder for cathode coatings poisons the cathode, thus shortening the life of the valve.

NEW ELECTRICAL EQUIPMENT

Tape Splicer

MULTICORE SOLDERS, LTD., Maylands Avenue, Hemel Hempstead, Herts, announces that an improved "Bib" recording tape splicer is now available. It is referred to as the



"Bib" recording tape splicer

Mark 2 and incorporates two tape retaining clamps which, in addition to having extensions on them providing an even easier releasing arrangement, are also fitted so that the clamp openings both operate identically towards the tape recorder. It is claimed that this makes tape splicing a quicker and simpler job without losing any of the virtually foolproof advantages of the original "Bib" product. The makers state that earlier models can be modified.

Silicone Rubber for Coating Glasscloth

Silastomer 132 is a new silicone rubber stock introduced by MIDLAND SILICONES, LTD., 19, Upper Brook Street, London, W.1, for coating woven fabrics from solvent dispersion. Silastomer 132-coated glasscloth is extremely flexible and is available from 0·004in thick. An initial high electric strength shows no decrease after long periods at 250 deg C. It is resistant to oxidation and a variety of chemicals and its good dielectric properties are maintained over a wide temperature and frequency range. Used as an insulant the glass cloth can permit higher loadings because of a good thermal conductivity.

Totally Enclosed Motors

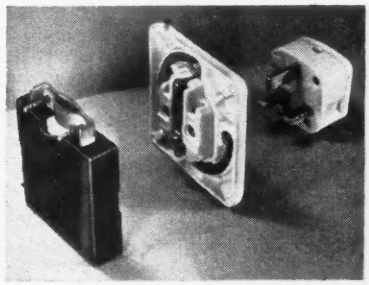
An addition to the "N" range of modern protected type slip-ring and squirrel-cage induction motors, made by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, is the newly designed series of totally enclosed, fan cooled machines which have been designated the "NK" design. With these the "N" range now includes motors having six different types of enclosure—screen-protected, drip-proof, pipe-ventilated, hose-proof and deluge-proof, as well as the new enclosure which is particularly suitable for dirt and dust laden situations.

The "NK" range includes outputs of 125 h.p. at 1,500 r.p.m., 450 h.p. at 375 r.p.m. and 1,000 h.p. at 750 r.p.m., and of particular note is the extremely efficient double air-cooling system.

In the case of the slip-ring design, a starting torque of 100 per cent of full load torque is available with a starting current of approximately 125 per cent of full load current. For certain requirements, increased starting torques can be arranged with correspondingly increased starting currents.

Plaster Depth Socket

A recent addition to the range of plugs and sockets manufactured by VOLEX ELECTRICAL PRODUCTS, LTD., Salford, 6, is a new plaster-depth 13 A 3-pin socket. Complying with B.S.1393, it has the advantage that it can be mounted in any plaster-depth box having $\frac{1}{8}$in internal depth and fixing centres to B.S.1299. The front projection is only $\frac{3}{32}$ in greater than the standard depth unit. It is available in either brown (V.1304) or cream



Volex plaster-depth 13 A socket shown with plug and "Blaco" box

(V.1304 CR) and the box recommended for use is the "Blaco" 63/5.

Brush Class VBA Switchgear

The Class VBA switchgear announced by the BRUSH ELECTRICAL ENGINEERING CO., LTD., of Loughborough, has been designed to meet the present-day requirements of Area Boards and industrial users for switchgear equipments to be operated on 11 kV and 6·6 kV systems having a fault level up to 250 MVA. The switchgear is suitable for use on 3-phase systems earthed to permit the use of standard circuit breakers in accordance with Clause 20 of B.S. 116/1952. Up to the present the "Q" type circuit breaker incorporated in this unit has been tested for breaking capacity ratings of 150 MVA at 6·6 and 11 kV, and 250 MVA at 11 kV. These ratings were obtained on a circuit breaker fitted with a hand closing mechanism, a making-current release being fitted for the ratings of 150 MVA at 6·6 kV and 250 MVA at 11 kV.

The circuit breakers are of the orthodox double-break design, and are fitted with arc-control devices of the side vented baffle type. Those circuit breakers having a breaking capacity rating of 150 MVA at 11 kV are fitted with contacts of the normal circular segmental type, and use brass for the fixed and copper for the moving contacts. For breaking capacity ratings of 150 MVA at 6·6 kV and 250 MVA at 11 kV, the fixed contacts have an extended contact with a copper tungsten tip.

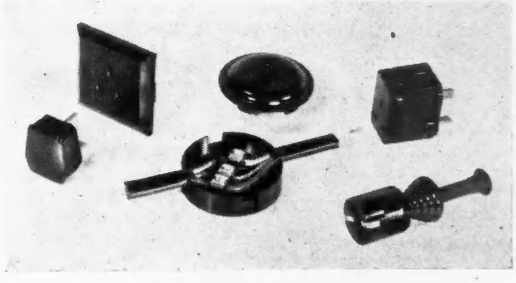
Wiring Accessories

New products recently announced by ASHLEY ACCESSORIES, LTD., Ulverston, Lancs, include a selective entry spur junction box, 13 A socket twin adaptor, 13 A socket and switch-socket outlets and an "easy-grip" appliance connector.

The junction box is designed for spur connections in domestic 13 A ring circuit installations. It is all-insulated with non-track base and has four open single or double cable entries. The indexed cover is fitted with a captive screw and integral shutters close the unused entries. The three in-line 30 A terminals take up to two flat t.r.s. 7·044 cables each. Fixing centres are 2in.

The well insulated adaptor has twin independently shuttered socket outlets and is capable of taking two 13 A B.S.1363 fused plugs. The total load is controlled by one easily renewed B.S.1362 cartridge fuse link. Two colours are available, brown (MPG.23) and cream (MPG.24).

The "easy-grip" appliance connector is suitable for kettles and other

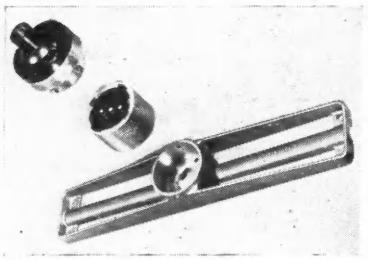


The new range of Ashley accessories showing 13 A plug and socket (left); selective entry spur junction box, with lid above (centre); 13 A twin adaptor (top right); and "easy-grip" appliance connector (bottom right)

domestic appliances taking 1½in diameter connectors, and has twin earth contacts and contemporary styling. Of all-insulated construction, it is suitable for 7½ A at 250 V; it is available in black only (C.1107). The 13 A socket outlets have a porcelain base and can be obtained in either surface or flush patterns in brown or cream.

Quick-Release Lighting Unit

A quick-release lighting unit for easy removal of a complete lamp unit for cleaning and maintenance has been introduced by CABLE STRIPPERS, LTD., Leighton House, Potters Bar, Middlesex. The lighting fitting is fixed to the



"Quik" lighting unit

lower part of the unit, using the long extra attachment for fluorescent fittings and the circular part alone for other types, and the wiring is terminated in the upper part: the two join together by a simple push and turn motion. The lugs taking the strain have been tested for a pull of 2,500 lb. Provision is made for two line and one neutral connection via spring loaded plungers.

Pre-Selectors

Two new pre-selectors, the PV98 and PV98A, have been introduced by the PLESSEY CO., LTD., Ilford, Essex. They are designed for use in conjunction with a single channel fixed frequency h.f. receiver, such as the PR53A, PR53C or PR51C, to provide switched selection of any one of five pre-set crystal-controlled channels in the frequency range 2·7-27 Mc/s.

Both pre-selectors comprise an r.f. stage, a crystal-controlled h.f. oscillator and a mixer, giving a low impedance coaxial output at a fixed frequency of 2·1 Mc/s. The r.f. stage is tuned by pre-set circuits and the oscillator stage is crystal controlled, the appropriate circuits being selected by a single five-position rotary switch manually operated from the front panel. Alternatively, the selector switch may be motor-driven from the rear, thus permitting remote control. Additional facilities are available on the PV98 for operation from external oscillators. The tuned circuits are mounted as plug-in units, six ranges being provided to cover the frequency band.

Each pre-selector contains an inbuilt power supply operating from 50-60 c/s mains. Tropically rated components are used throughout.

Cable Ratings and Soil Thermal Resistivities

The following statement relating to cable ratings and soil thermal resistivities has been issued by the Cable Makers' Association with the authority of all British cable manufacturers concerned with the production of impregnated paper insulated power cables for any voltage.

The forthcoming publication by the British Electrical and Allied Industries Research Association of a new booklet (reference F/T.183) entitled "Current Ratings for Paper Insulated Cables to B.S. 480: 1954, and Varnished Cambric Insulated Cables to B.S. 608: 1955," contains two tabulated sets of ratings for cables laid direct in the ground (and for cables in underground ducts) based on two alternative values for soil resistivity, namely, g=120 and g=90. This is a departure from past practice because in the earlier ratings published by E.R.A. (reference F/T.128) all ratings for cables laid direct in ground or in ducts were tabulated for just the one value of soil resistivity, namely, g=120. It was possible, however, to obtain the rating for any other value of "g" from a curve of correction factors which was given in the same booklet.

In the new publication these correction factors are still included, but instead of giving them in the form of a curve, actual factors are tabulated for fixed values of "g," viz: 60, 150, 180, 210, 240, 270 and 300, with the advice that in order to take account of irregularities in soil conditions along the route the current rating or rating factor appropriate to the value next *above* the maximum measured value should be used. Soil thermal resistivity measurements should therefore be an essential preliminary to the determination of the correct current rating for a given cable, and it is to be hoped that one effect of this new publication will be to encourage users to determine soil resistivities along their cable routes in order that the correct current rating can be applied. The situation, however, must be faced where such figures for soil resistivity are not available or are not readily obtainable.

Hitherto the practice has been to assume a soil resistivity of g=120 and the result has been eminently satisfactory. The publication of tabulated ratings for a lower value of "g" in no way affects the position and the cable industry of this country will continue to base its current ratings on g=120 in all cases where a more precise figure is not available. In thus continuing a long established practice the industry is not being unduly conservative or pessimistic because there is very good reason to believe that in many instances soil conditions in this country fall within the range 90-120 and, as already stated, to take account of irregularities along the route, the cable rating should relate to the highest value and not the lowest or the average.

Nowadays there is an increasing tendency to operate cables at or near their maximum limit of temperature by, for example, taking proper cognizance of the actual shape of the load curve and applying peak ratings which are substantially in excess of the tabulated continuous ratings. This practice, correctly applied, is safe because it does not involve the maximum safe temperature of the cable being exceeded. Furthermore, the maximum operating temperatures of all cables for working voltages up to and including 6·6 kV have already been increased by 10 deg C and the current ratings increased accordingly.

In view of the above the actual value of the thermal resistivity of the soil becomes more important. The procedure therefore which the cable manufacturing industry recommends as soon as the new ratings are published may thus be summarized:—Wherever possible actual measurement of soil resistivity should be taken at suitable intervals along the route or otherwise the probable maximum soil resistivity should be assessed from the information given about different soils in the new publication. When neither course is practicable the cable rating should be that corresponding to g=120.

The thermal resistivities of a material "g" is the temperature difference in deg C between opposite faces of a centimetre cube of the material to produce a flow of heat of 1 watt and is expressed as so many "thermal ohm-cm" or "deg C cm per watt."

Electric Trains in West Bengal

It is hoped that by the middle of 1957 it will be possible to run electric trains on the Howrah-Bandel-Burdwan section of the West Bengal railways, including the Tarakeswar branch. Speaking on the subject recently, Mr. K. B. Mathur, a member of the Railway Board of India, said that the work now under way was mainly concerned with the civil engineering side of the project. Electricity would be supplied by the Damodar Valley Corporation. The second and the third phases of the Calcutta surburban railway electrification, which would include Dum Dum, Kidderpore Docks, Budge Budge, Canning and Ranaghat sections of the Sealdah Division, were likely to be put in hand towards the end of 1956.

Technical Publicity

Some Notes on its Editorial Preparation

By E. H. W. BANNER, T.D., M.Sc., M.I.E.E., M.I.Mech.E.

IN general there are two distinct aspects of the preparation of technical publicity: these are (1) policy and (2) practice, including editorial and technique. The second only is dealt with here, with notes which are in the province of the publicity departments of smaller firms, and those firms who put out their technical publicity to agents who may not be entirely familiar with the engineering details, since they may deal with commodities ranging from breakfast foods to nightlights. Much of the detail of the preparation of technical publicity matter applies almost equally to that aspect of technical advertisement writing, but the important subject of advertisement layout is quite outside the scope of this article.

Although policy is excluded here, in places it is relevant since one man, possibly with a junior assistant, may have to deal with the whole subject from determining the amount and form of publicity, writing it technically and finally preparing it editorially for press. This is sometimes the case in a small firm, especially one newly entering the field on account of the rapid growth of engineering, particularly in electronics.

Technical and Editorial

Provided that he is trained and experienced in engineering and has subsequent editorial experience, one man is well able to perform all functions, but where technical publicity is regarded as an inconvenient necessity to be turned over to anyone who can spare the time—or even to someone who cannot—then the result is not likely to be so good as it ought to be.

Technical publicity is both science and art, and the head of the department normally deals with both sides, unlike a managerial head who can be unconcerned with detail. The publicity head should be able to view the matter from two aspects—technical and layout—and should have an editorial mind.

On occasions someone in the works produces notes on a particular product with which he has dealt, and these often persist in the original form right through to the printer without editing, although probably altered to n improved layout which may then possibly be technically incorrect. Correct editing by an experienced technical editor can avoid this, and it also provides a valuable second opinion as a check.

In a technical description it is better to avoid such generalities as "made of special material," "hardened by our special process," etc. If the reader is an engineer he will often be put off by such vague references to processes and methods hinted at as beyond his understanding.

Many colloquialisms, while unobjectionable in conversation, are misleading in print, particularly in technical matter. The term "just about" is an example; strictly the two words are contradictory, first implying precision, then approximation. A good example of what to avoid is well remembered by the writer. A firm's salesman had to reply to an inquiry asking for an assurance that a certain relay was quick-acting. With the praiseworthy intention of satisfying the inquirer the salesman informed him that "This relay operates in no time or even less than no time."

Many engineers and technologists will not take the trouble to learn and use correct terminology, as specified in the relevant British Standards. There are two good reasons why correct terms should always be used, and why in this case individual preference should be subordinated, if necessary. The first reason is accuracy. A term which is wrong may not only mislead but cause trouble in various ways. The second reason is that the reader must be helped. Unless the material is something of immediate interest, such as an official proclamation, forthcoming sales, a statement on wages or charges, etc., readers will not read uninteresting matter, or matter presented in an unattractive way.

It is necessary to present the material attractively and in a way that can be readily understood, otherwise the reader will pass it by. The reader is bored if he has to "translate" the writer's terms into standard and accepted terminology. If unknown terms are present, or well-known things are called by unfamiliar names, then the reader just will not bother and the whole point of the publication may be lost. Generally there is one correct term and any number of incorrect terms. It thus seems self-evident that the correct term is the best to use.

Standard Terminology

On the technical-editorial side various British Standards apply. The Glossaries of Terms are the standards for their purpose, and both meaning and spelling should be followed. Standards for terminology are of course as published by the British Standards Institution, mainly in the form of Glossaries. The authoritative guide, B.S. 1991, Pt. I, 1954, *Letter symbols, abbreviations and signs of common interest in Physics, Chemistry and Engineering*, is the standard for the general aspect of the subject. A list of some Standards appropriate to engineering publicity is given at the end of this article.

Correct symbols and abbreviations should alone be used, noting that in both cases the singular and plural forms are the same. There is no plural "s" after a symbol; "s" is itself an abbreviation for seconds of time (as also is "sec"), so that "mAs" is not milliamperes but milliampere-seconds or millicoulombs. Also "lb" is correct for pound and pounds; the Latin word *libra* from which "lb" is obtained does not take the plural "s," so "lbs" is incorrect.

Care is necessary to employ correct prefixes before symbols for quantities. The non-technical publicity man and advertisement writer frequently will not realize that "m" and "M" are a thousand million times different, and only technical editing at all stages can prevent errors from occurring, especially in electrical engineering. "MF" is sometimes used to denote microfarads instead of "μF," but the numerical difference here is a million million times. Similarly "m" and "μ" are quite different; "mmf" really means "μf," but what is intended is "$\mu\mu$F" (or "pF"). Wrong symbols such as "M/A" and "mFd," although possibly not leading to

error, tend to put off the reader by requiring extra mental effort to translate to the correct term.

Another frequent abuse of symbols is to combine words with symbols or abbreviations. Symbols for units are intended for use following numerical quantities, such as the common electrical "V," "A" and "Ω," following numbers as 2 V, 3 A, 4 Ω, etc. But the hybrids of "meg Ω," "m/amp," "k. volt," etc., are incorrect and the practice is misleading through making the matter difficult to read and interpret. Either the word should be in full, such as megohm, or it should be fully symbolized as "MΩ."

The use of these symbols other than following numbers may lead to confusion, such as "the V in the circuit"; the word "volts" should here be written in full. Inconsistency such as "c.p.s." and "c/s" nearby should be avoided; the latter is the basic symbol and to it can be added any recognized prefix, making "kc/s," "Mc/s," and even "kMc/s." The ability to combine any multiplying or dividing prefix with any unit symbol is so simple that it is far simpler to use the correct procedure than a wrong one. Unless both the writer and the prospective reader are familiar with correct abbreviations and symbols it is better to write the words in full.

While this short article does not attempt to cover all editorial matters it is emphasized that incorrect technical terms, punctuation, etc., can lead to quite erroneous meanings. For example, the hyphen is tending to be replaced by the oblique stroke (solidus) in many cases. In technical work this can cause errors such as printing 20 ft/lb where a force or torque of 20 ft-lb is intended; 20 ft/lb means literally 20 ft per lb weight, such as in specifying cable, wire, strip metal, etc. Torque is sometimes expressed in units of mass or weight multiplied by distance, such as lb-ft. It is better to follow the normal sequence of length, mass and time (or L.M.T.) units, e.g., ft-lb.

Photographs

Some points of detail in supplying photographs with technical publicity are worth mention, since photographs are frequently asked for by editors and writers. The photographs vary very widely from firm to firm; some are taken by a junior and very poor photographs are produced; other firms take considerable care and prepare good photographs of a large size, such as 8in by 10in or larger. In almost all cases photographs need retouching before block-making, however good the original photography. Shadows have to be removed, or added, and backgrounds often need to be made less conspicuous. Unfortunately this retouching is fairly expensive and the retouched photograph is then unique. Methods of distributing copies are:—(1) Sending copies of the original unretouched photograph for the journal to prepare; (2) sending the retouched photograph and asking for its return; and (3) making copies of the retouched photograph and always sending these.

A further point regarding photographs sent out is that certain particulars, including the firm's name and the caption, should always be affixed to the back. Writing directly on the back of the photograph is liable to show on the front and entail extra retouching. Rubber stamps for the firm's name and address are permissible, but the actual caption and any reference numbers should be typed on a strip of paper which is then affixed at its ends.

Photographs without full particulars affixed are liable to be separated from their covering letter and it may then be quite impossible to identify the firm or the item of equipment, thus wasting the photograph, or causing wrong identification, which will usually be worse. Although apparently obvious, it is not always realized that office juniors sometimes fold photographs for post; this ruins them for block-making and even a paper clip will sometimes make a mark. Backing with stout card and packing in a transparent envelope inside a stout outer envelope is by far the best way to post photographs. A "With Care" label has little practical effect.

APPENDIX

The following is a selection of appropriate British Standards. Full lists and details may be obtained from the British Standards Institution, 2, Park Street, London, W.1.

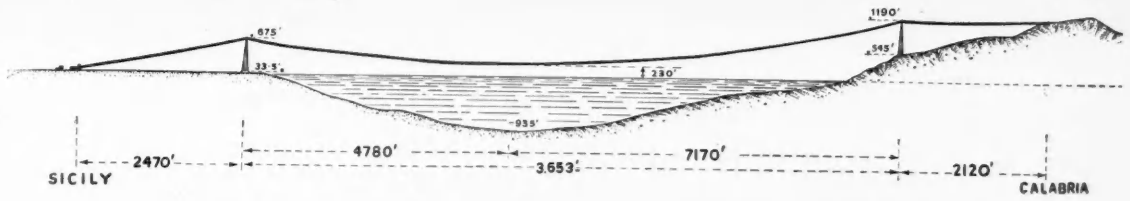
General.—		
B.S.1991: Pt. 1:	1954	Letter symbols, abbreviations and signs of common interest in Physics, Chemistry and Engineering.
B.S.1219:	1945	Printers' and authors' proof corrections.
B.S.1219C:	1945	Table of symbols for printers' and authors' proof corrections.
Engineering, common.—		
B.S. 308:	1953	Engineering drawing practice.
B.S.1523:	1949	(Section 2) Process control.
	1954	(Section 3) Kinetic control.
	1954	(Section 5) Components of servo-mechanisms.
B.S.1646:	1950	Graphical symbols for instrumentation.
Mechanical engineering.—		
B.S.2517:	1954	Definitions for use in mechanical engineering.
B.S.2094:	1954	Glossary of terms relating to iron and steel.
B.S. 499:	1952	Glossary of terms (with symbols) relating to the welding and cutting of metals.
B.S.1420:	1947	Glossary of terms applicable to wrought products in copper, zinc and other copper alloys.
B.S.1553: Pt. 1:	1949	Graphical symbols for pipes and valves.
Pt. 2:	1950	Graphical symbols for power generating plant.
Pt. 3:	1950	Graphical symbols for compressing plant.
B.S.1798:	1951	Symbols, terms and definitions for gas quantities in reciprocating internal combustion engines.
B.S.1584:	1949	Glossary of terms used in refrigeration.
B.S.2468:	1954	Classified glossary of terms relating to agricultural machinery.
Electrical engineering.—		
B.S. 205:	1943	Terms used in electrical engineering.
B.S. 205:	1943	Terms used in telecommunications (with supplements).
B.S. 233:	1953	Glossary of terms used in illumination and photometry.
B.S. 108:	1951	Graphical symbols for general electrical purposes.
B.S. 530:	1948	Graphical symbols for telecommunications (with supplements).
B.S.1409:	1950	Letter symbols for electronic valves.
Classification.—		
B.S.1000:		Universal decimal classification (published in various parts).

E.A.W. Conference

THE 30th annual conference of the Electrical Association for Women will be held in London this year on 26th and 27th April. In the evening of the first day there will be a soirée at the Royal Institution, Albemarle Street, W.1, when Sir Lawrence Bragg will give an address, "Thirty Years of Electrical Progress."

On the following day delegates will register at the Connaught Rooms, Great Queen Street, W.C.2, after which the annual general meeting will be held. At the luncheon which follows, Lord Citrine will propose the toast of "Thirty Years—the Contribution of the E.A.W. to Progress," to which the Dowager Lady Swaythling (president) will respond. Other speakers will be Mrs. J. L. Stocks and Sir Vincent de Ferranti. The National Advisory Council meeting will be held in the afternoon, and for those not attending the Council meeting a visit has been arranged to the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

The golf competition for the Lady Hughman Challenge Bowl will be played off at the Bush Hill Park Golf Club, Bush Hill, London, N.21, on Tuesday (26th April). Play will commence at 1 p.m. and at 4.30 p.m. there will be tea and the presentation of prizes.



Cross-section of the Strait

Crossing the Strait of Messina

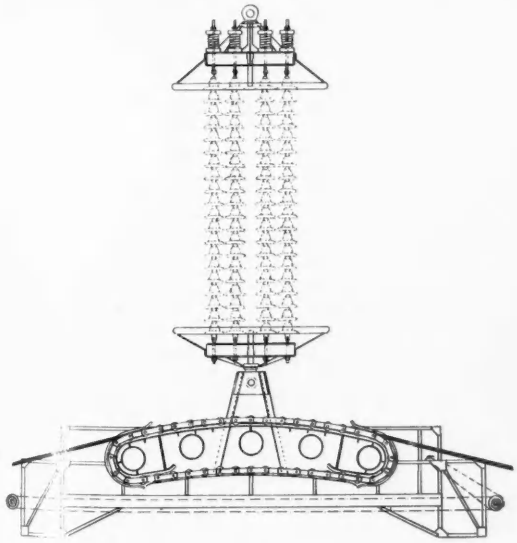
LONGEST OVERHEAD LINE LINK IN THE WORLD

NOW going into service in Italy, from Sicily to the mainland across the Strait of Messina, is a transmission line which is believed to be the longest overhead connection of its kind in the world. Progress on it was reported in our issue of 17th December, 1954.

After the first world war it was realized that the Sicilian hydro-electric plant would not always be able to supply the island's energy and that integration with the system in Sila, on the mainland, was desirable. Originally a tunnel under the Strait was suggested, but the idea was abandoned because of the considerable depth to which such a tunnel would have to go, and because of the liability of the area to volcanic action. The Società Generale Elettrica della Sicilia (S.G.E.S.) also considered using cables on the sea bed but this idea was felt to be a doubtful possibility. An overhead line appeared to be the only absolutely certain way of approaching the problem, and after various studies had been made, an agreement was arrived at in 1948 between S.G.E.S. and the Compagnia Nazionale Imprese Elettriche for the construction not only of the actual crossing but also of the line from Feroleto to the Caporafi plain. This joint venture obtained the necessary permit from the Ministry for Public Works, and its construction began on 27th January, 1952.

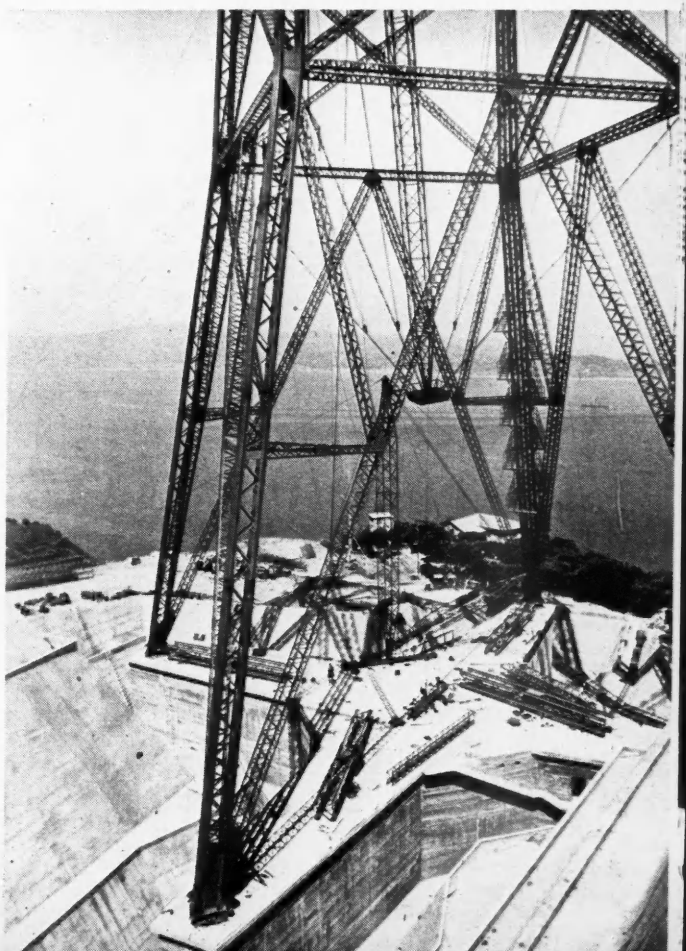
In the scheme adopted the traditional crossing Cannitelle-Ganzirri was replaced by another one between Torre Cavallo and Punta Sottile utilizing a rocky spur of considerable height on the Calabrese coast. It was possible to put the supporting plane of this tower 545ft above sea level, thus reducing the required height for both towers, the difference of altitude being 512ft between the two sides of the crossing. The crossing span has a horizontal length of 11,950ft, while the end spans on the Sicilian and Calabrese coasts are respectively 2,470ft and 2,120ft long.

Accurate studies, with a distance of 65ft between adjacent conductors, showed that the danger of mutual wire contact was no more serious than in existing and well-tested installations. A distance of 82ft between conductors was then adopted for safety, with the possibility of eventually installing six conductors (two three-phase circuits) on one



Conductor suspension arrangement

Tower under construction, showing foundations



tower. Only two towers were consequently needed for the crossing, with a very important technical simplification and a considerable saving of money.

The element that required the most accurate study was the conductor, because upon its characteristics depended the permissible sag and consequently the tower height. The adopted type has a diameter of 1·09in with a steel section of 0·48 sq in, an aluminium section of 0·045 sq in, a weight per ft run of 2·3 lb, and an effective breaking load of 55·5 tons.

Instead of rigidly fixing the conductor at both ends, it was decided to moor it on the Calabrese coast and counterweight it at the opposite end on the Sicilian coast. The conductor is then stressed in a constant manner, and the stress does not vary with temperature and external loads. This gives the possibility of a lesser sag and consequently of a reduced tower height. In order to permit the free action of the counterweight the conductor is disposed on roller supports. With this arrangement the crossing presents all the mechanical characteristics of an aerial ropeway. Great attention was given to the tower foundations, one consideration being the exceptional stresses in case of seismic phenomena. With the arrangement adopted the tower height necessary was reduced to 735ft, but even at this the crossing of the Messina Strait constitutes a world record in the sphere of transmission line towers.

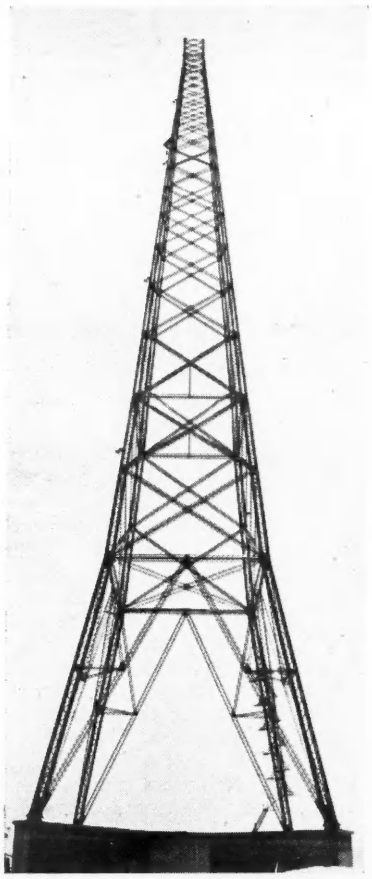
The crossing (with the line for connection to the Sila plant) is meant for final operation at 220 kV. In the first stage the connection with the Sila plants will be by one 150 kV circuit with a capacity of 50,000 kW; in a second stage, increasing the voltage to 220 kV, the capacity will be 150,000 kW. These figures can be doubled by completing both three-phase circuits.

The foundation on the Sicilian coast is supported by a sand bed; the deepest sounding taken in the zone revealed the presence of sand down to a depth of 760ft below sea level. In relation to this a monolithic-structure foundation was made up of a cross-shaped block of reinforced concrete connecting rigidly the four legs of the tower and resting on sand at a depth of several feet. This block has four pillars into the underlying sand, each 65ft deep and positioned below the four legs of the tower. The work required the open-air excavation of about 2,500 cu yd and the compressed-air excavation of about 6,000 cu yd of sand; 4,500 cu yd of concrete and 480 tons of steel bars were used in the foundation itself. On the Calabrese coast the foundation is supported by rock and is similarly constructed of a cross-shaped monolithic block of reinforced concrete, pillars being unnecessary in this case.

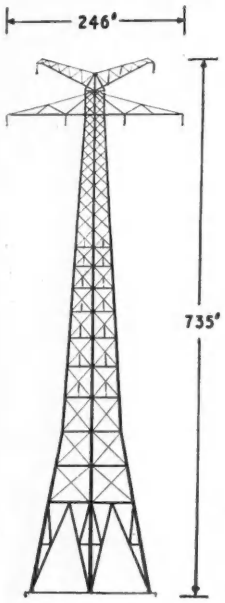
Each tower is designed to carry six conductors placed at the corners of two equilateral triangles with sides of 82ft; four conductors, at a distance apart of 82ft, are disposed on a plane at a height of 640ft above the tower base, and two upper conductors are at a height of 710ft. The beam that supports the four conductors has a length of 246ft, while the top cross-arm has a total width of 164ft. Initially only the first four conductors will be strung but the towers are erected with the supporting arms for the top two.

Both towers are identical and able to resist a transverse wind of 93 m.p.h., a longitudinal pull of 25 tons applied at any point of support for conductors, and a 10 deg earthquake on the Mercalli scale. Each complete tower has a winch in its upper part, service stairs, and a lift, situated externally along a stanchion. For the safety of air and sea traffic the towers will be painted with alternate red and white stripes; illuminated signals will be given from the upper part and along the stanchions.

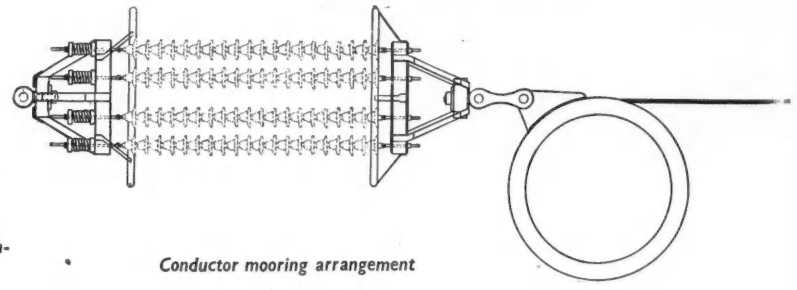
The total cost amounts to about £1½ million.



One of the towers almost complete



Outline of complete tower



Conductor mooring arrangement

Wind Power Generation

Investigations in this Country and Abroad Discussed

MR. E. W. GOLDING'S paper on "Electrical Energy from the Wind" (see *Electrical Review*, 1st April) was discussed at the Institution of Electrical Engineers on 31st March. Mr. T. G. N. Haldane (Merz & McLellan) described the paper as an important contribution to world knowledge of wind power. Large wind-power plants could be erected on many sites in this country and it was disappointing that more progress had not been made in their design and construction. The original object had been coal-saving with a step-by-step development from 100 kW plants to 1,000 kW or more, but even the first stage had not yet been completed. For isolated communities, mainly abroad, medium-scale plants might be extremely valuable, but he was dubious about satisfactory developments by large numbers of small plants.

Professor D. Dresden (director of the Department of Industrial Research of the Netherlands) pointed out that the cost of erecting the windmill structure depended on the force of the wind and that, as first cost was the main item in the cost of electricity so generated, it was important to determine the maximum probable wind speed. If a higher speed occurred later the station would suffer, but no architect built a house to withstand wind thrusts not known to occur previously.

Mr. W. T. J. Atkins (C.E.A.) said there had been public opposition to windmills because of their size and allegedly unattractive appearance. As a result the C.E.A. had so far been unable to use the Caernarvonshire site for which the first machine had been designed and it was still on a temporary site near the manufacturer's works, where trial runs had taken place, but this site was inadequate for serious operation. The long-term prospect of large groups of plant in this country was therefore grim. Development might lead to windmills assuming what were regarded as more pleasing forms.

Mr. J. Juul (S.E. Zealand Electricity Co., Denmark) said that they would have to become familiar with the idea of using a large number of small units working automatically. Atomic energy would not make wind power superfluous because all the energy which could be advantageously produced would be needed. Dr. R. Frith (Meteorological Office) described an analysis which he had made of wind variability.

Teething Troubles

Mr. T. Mensforth (John Brown & Co.), described teething troubles with the 100 kW Orkney windmill, the most powerful aero-generator yet to be operated on a permanent site in this country. For a first experimental unit, the Orkney site was not a success; months had been lost owing to rough weather and there were virtually no local workshop facilities. Resonance of the hub and blade system had been troublesome. A governor performance higher than that easily obtainable was needed to ensure stability and steady output under widely varying wind conditions, and hunting had been troublesome. The tower was unnecessarily tall in relation to the diameter swept by the blades and therefore less rigid than was desirable, so that tower resonance could occur when the rotor was turning at less than the normal r.p.m.

For the rotor of a projected 250 kW windmill, his firm proposed to use two blades supported by a rocking yoke instead of three hinged blades. The blades should be slender, because high lift coefficients helped to reduce the shocks caused by steep-fronted gusts and made governing less exacting. The tower should be fixed, of steel construction. The blade-tip to ground clearance should be about 25ft. To erect the blades on a fixed tower was not difficult and there was little justification for ingenious but expensive collapsible towers. The generator should be mounted aloft in the nacelle with better safeguards against dampness. The induction type was favoured. Good power-factor correction could, if required, be provided by capacitors, but complete correction was undesirable because of the danger of self-excited over-voltages on open circuit. Oil-operated pitch control of output for the largest sizes seemed the most attractive method. The author's £55/kW was much less than his firm's estimate for a 250 kW design. The kW rating varied directly as the swept area, i.e., as the square of the linear dimensions, while the structure weight varied as the cube, so that weight and cost per kW rose with increasing ratings; but up to an optimum size this tendency would be more than counterbalanced by other influences. He suggested perfecting machines of 250 kW, and then perhaps 600 kW, before going further.

High-Speed Automatic Machines

Dr. U. Hütter (Allgaier-Werker, Germany) said the present tendency in Germany was towards the development of automatic machines of a high rated speed, which permitted the use of a small gear, and thus a low weight and low cost. Many machines of 6 kW to 50 kW were on the market. His organization had supplied 60 such machines to a number of countries, and 34 operated in Germany. An organization for the study of wind power, founded in 1949, had promoted a competition for a 100 kW machine which had been won by the group of designers to which he belonged. They hoped that the construction of the machine would be begun early in 1956 and its tests undertaken by the end of that year. In the meantime they had provided the power for a pumping station of 60 kW by connecting eight wind-power machines of 8 kW together, which had been working satisfactorily for more than a year; there were no difficulties in running the eight machines in parallel. A 1,000 kW unit could be made up of ten 100 kW machines, which might be mass-produced.

French Research

M. A. Argand (Electricité de France) said that research in France for the last few years had been on parallel lines to that in Great Britain. Large numbers of sites had been prospected and anemometer readings recorded. Aero-generators would have to supply a widely-interconnected network with power that was very unsteady. No method was now known for storing an adequate quantity of power so as to regularize the output of aero-generators even of 20 to 30 kW. He knew of no instance in which they had been coupled with regularizing units, such as heat engines, without storage batteries. Low-power wind turbines might be used for supplying lighthouses, which would form a strong and unobstructed support and were

looked after by qualified people who had already large storage batteries.

Mr. H. Munro (Electricity Supply Board, Dublin) said that on the extensive rural electrification network in Ireland there were very few isolated loads for which wind power could be used, so they were interested only in the large-scale utilization of wind power, operating in parallel with the network. A windmill to feed a network had to be designed, constructed and operated in a totally different way from one which fed an isolated load. Smaller windmills than had hitherto been envisaged for network use, might be grouped. The immediate target might well be units of 100 to 200 kW of simple design.

M. Fouquernie (Chantiers et Ateliers de France) said that a French organization was developing the Andreau generator, which operated by what the author described as the "depression" method. He considered that there should be great scope for using wind energy in Africa and Asia.

Mr. C. A. Cameron Brown (C.E.A.) recalled that the first recognition of the possibilities of using wind power for the generation of electricity had been made by the Ministry of Agriculture and Fisheries, which in 192 invited the world to send the best that they had in electrica wind generators for tests in this country. Some ten plants had eventually been submitted.

Mr. R. A. Fitch suggested, on the analogy of the gigantic dams used with water power, the building of a gigantic concrete funnel to collect the wind, and giving a non-turbulent flow with everything at ground level. A large ring of massive material and behind this a much lighter funnel terminating in a fairly high-speed turbine might be sufficient.

The author, in a brief reply, said that elsewhere Mr. Juul had estimated the cost of his 200 kW machine at £50 to £55 kW. If a 200 kW machine could be made for such a figure it might be an encouragement to think in terms of a larger number of smaller machines.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Church Heating Installations

IN his letter in the *Electrical Review* of 1st April, Mr. Lash quite rightly says there will be empty pews in churches during the winter when the Church Council are content with planning for a temperature of 48 deg F during evening service (or any service for that matter), and I agree with him in the case I described, but for a very different reason; in fact the whole building is empty as no services are held at such times.

Leeds. R. L. GAUNT.

IT is indeed surprising that after all these years, and particularly the more recent post-war years when so much has been done and so much written about it, that there is any doubt, especially in the minds of electrical engineers, as to the best method of electrically heating a church. I write this after reading Mr. R. L. Gaunt's article in your issue of 11th March, and the letter of Mr. A. R. Lash, M.I.E.E., in your 1st April issue.

Referring to Mr. Gaunt's installation, I would express the opinion that this is precisely a clear case of what happens with such a method of heating a church. Although the loading of 43 kW is approximately that which a tubular heating installation would require, the unit consumption is nearly double and the reason for this is, of course, obvious. A hot water installation requires to be switched on the previous day, whereas about 2 to 3 hours' pre-heating is sufficient for tubular heaters. Other advantages with a tubular heating installation are self-evident—better heat distribution, freedom from draughts, a constant temperature, more rapid response to ambient temperature changes, a minimum of maintenance and no liquid to worry about in frosty weather.

In regard to Mr. Gaunt's assertion that after extensive inquiries he could find no information on the electric heating of churches, had he contacted any of the well-known electric space heating manufacturers, quite apart from the British Electrical Development Association, he could, I am sure, have obtained all the facts.

Mr. Lash refers to a loading of 50 kW for a church having a floor area of 1,660 sq ft, and he talks about a 24-hour pre-heating period. I think that a loading of 25 kW to 30 kW would have been ample for comfort conditions, together with a 2 to 3 hour heating-up period. Many hundreds of churches have been successfully heated by direct electric heating equipment, some going back as far as the late 1920's, and in most cases the operating cost has been less than solid fuel with equivalent comfort conditions.

Welwyn Garden City. C. B. CLELAND.

Power Capacitors

TO bring the previous editions of B.S. 1650 into closer agreement with the recommendations of the International Electrotechnical Commission, the British Standards Institution has just published B.S. 1650:1955, "Capacitors for Connection to Power-frequency Systems."

It is intended to apply primarily to capacitors having mineral-impregnated paper dielectric, covering continuously rated capacitors, such as those which are used for power factor correction purposes and intermittently rated capacitors of the type used for motor starting. Although large series capacitors rated at 1 kVAr or greater are not included within its scope, smaller series capacitors, such as may be used in some fluorescent lamp circuits are covered by the new standard.

The main changes in the new edition are increases in the permissible overload current for capacitors rated at not less than 1 kVAr; from 10 per cent to 30 per cent for continuously rated high voltage capacitors and from 10 per cent to 15 per cent for low voltage capacitors. There is also a clearer classification of the routine and type test clauses. Among the additional items which have been introduced are a stability test, and a test for the efficacy of the discharge device. The new definition of "rated insulation voltage" may in some cases be different from the rated voltage of the capacitor dielectric.

Copies of the new standard may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 5s.

KIDBROOKE HIGH SCHOOL

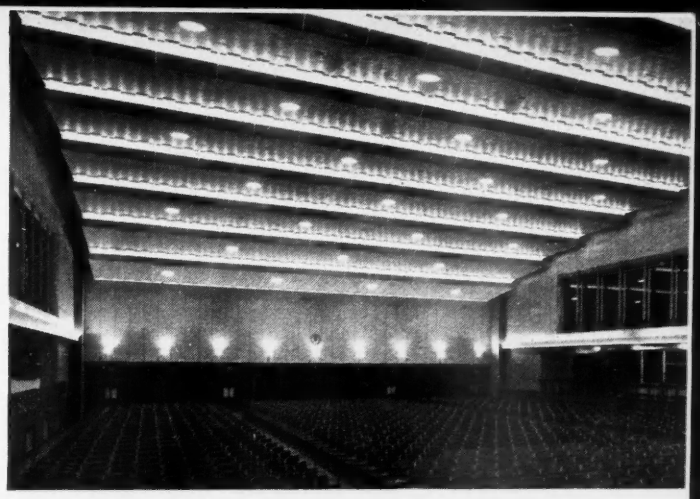
Modern Lighting Installation

THE assembly hall of Kidbrooke Comprehensive High School which has recently been completed, has one of the most up-to-date electrical installations to be found in a building of this character. The scheme was prepared by Edward A. Pearce & Partners, consulting engineers, who were responsible for the whole of the electrical and mechanical services for the school.

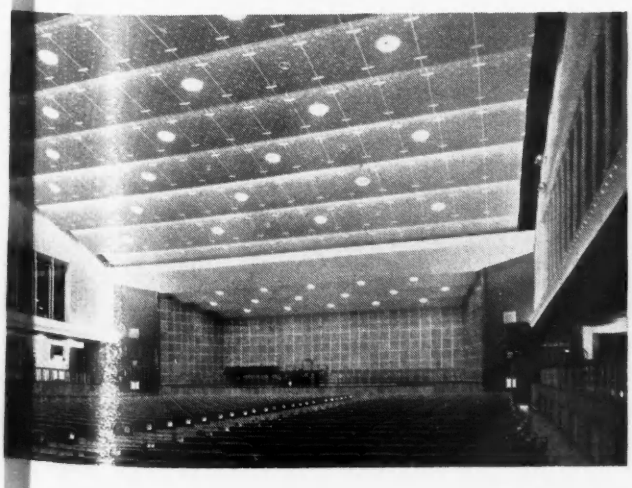
The hall ceiling comprises a number of overlapping plaster panels with the edge facing the stage turned up to form a cove in each panel. The succeeding panel is some 3in to 6in higher. The ceiling has been painted light grey with white relief and the two window walls and rear wall are acoustically treated and painted cream. The two flanking walls adjacent to the stage are blue and the stage panelling is light grey. "Colourglaze" 25 W lamps spaced at 1ft centres have been provided along the whole length of each cove, recessed behind the raised front portion and with removable hardboard reflectors painted white behind them. Thus, each cove has a continuous tungsten batten, the whole luminous output of which is thrown on to the succeeding ceiling panel. The effect of these coves alone would have meant that the walls would be rather dark and, therefore, similar battens behind a plaster cove have been installed along each window wall. A similar effect was obtained on the rear wall of the hall by use of "Diabolo" fittings.

The direct illumination is afforded by thirty-two 300 W recessed ring louvred fittings. The illumination afforded with the indirect lighting only is 1·5 lumens/sq ft and with the direct lighting in addition a total of 8 lumens/sq ft is obtained.

The stage is principally used as a concert platform and thus permanent general lighting was installed. Due to the large angle of the ceiling in relation to the floor, ring louvred fittings would not have proved effective in so far as cut off was concerned. Therefore, a total of sixteen slat louvred fittings was installed. The row nearest the front of the stage has a cut-off of 60 deg and is used with 200 W clear lamps and the two rear rows have a cut-off of 45 deg utilizing pearl lamps. The side galleries are lit by means of 2×60 W ceiling hemispheres.



The assembly hall of Kidbrooke High School showing the modern architectural treatment and lighting installation



The whole of the hall and stage lighting may be dimmed either in sections or together. There are two positions for control and these are the porter's lodge at the rear of the hall and the store to the actors' left of stage. In order to comply with licensing regulations, "panic" lighting had to be provided with control from the porter's lodge. Thus, the porter's lodge control panel has automatic priority over the panel in the store on the actors' left of stage and no matter what the position of the controls in the store, the person in control of the panel in the porter's lodge can switch all lights to full on.

The small ring louvres, which are unlit in the photograph, conceal in four cases emergency lamps and in the remaining cases the ceiling loud speakers. The two square grilles on the flanking walls of the stage also conceal loud speakers and the rectangular ceiling plates which can be seen in the side galleries are further loud speakers. Three microphone points are provided on the stage. The whole of the loud speaker system is controlled from a point at the rear of the porter's lodge. Each exit sign is provided with both primary and emergency lamps.

The panels on the actors' left of stage have been so arranged that they can be swivelled and form a vision panel for the stage switchboard operator. The board is installed at approximately 8ft above floor level and is permanently wired to dip boxes in the floor. A fit-up stage lighting system has been provided and the positions of the stage dips are so arranged that they occur in the corners of the fit-up legs. The fit-up itself is permanently wired to plug in boxes at the top of the legs and flexible leads are taken from there to No. 1 flood and spot bar and No. 2 batten. The 500 W front of house spots can be seen in the photograph on the two walls above the windows and these again are permanently wired back to the stage board. The two large windows are fitted with motor-operated venetian blinds which, it is claimed, are the largest in Europe.

The architect was Mr. C. Pike (Slater, Uren & Pike); the structural engineers were Ove Arup & Partners; the principal contractors, Gee, Walker & Slater, Ltd., and the sub-contractors for electrical services, Holliday, Hall & Stinson, Ltd. Lighting fittings were supplied by Courtney, Pope (Electrical), Ltd. (direct ceiling fittings and "Diabolo" fittings) and S.L.R. Electric, Ltd. (ceiling hemispheres). The sound system is by Sound Diffusion, Ltd., the emergency battery by Chloride Batteries, Ltd., and the auditorium dimmer and stage lighting equipment by the Strand Electric & Engineering Co., Ltd. The venetian blinds were supplied by Venetian Vogue, Ltd.

NEW BOOKS

The Insulation of Electrical Equipment. Edited by Dr. Willis Jackson. Pp. 340; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 42s.

It has long been the custom for universities and technical colleges to devote some part of the long vacation to conferences, colloquia and short courses of highly specialized instruction. The summer school is a well-known institution whereby experts from different sources can meet for an exchange of ideas, each making his individual contribution under the direction of some eminent person whose advance planning and control weld the separate components together to form a coherent whole. The experience is of immense value to both student and tutor because the practitioner brings with him an industrial atmosphere which conditions his offering. The consequence is that a subject like electrical insulation, for example, is expressed in terms of busbars and bushings as well as vectors and valencies.

Usually, the sum total of the papers and discussions is of sufficient value to justify some form of permanent record, but the task of collecting, collating and editing the subject matter is formidable. Engineers are therefore much indebted to Dr. Willis Jackson for having done this so admirably after the vacation course on the insulation of electrical equipment held recently at Imperial College, London.

Dr. Jackson was supported by ten specialists whose names alone are sufficient indication of the calibre of the work. The proceedings began with an historical survey of the development of electrical insulation, by the Convener, followed by a dissertation on properties in relation to structure by Mr. C. G. Garton. Dr. Hartshorn then dealt with dielectric power-loss in the stable range, and Dr. S. Whitehead with instability and breakdown.

So far, the contributors would reasonably be expected to speak with complete detachment, and it is commendable that consideration was next given to the influence of production problems on the outlook. So Mr. R. Snadow, of the British Thomson-Houston Co., Ltd., took over the vexed question of classification from the manufacturers' point of view, and Mr. I. M. Ross of S.R.D.E., Ministry of Supply, reviewed electrical insulation from the communication engineers' angle. The important subject, cables, was covered by Dr. L. G. Brazier and large industrial machines (generators and motors) by Dr. R. S. Vincent.

Power transformers were well covered by Mr. E. Jones of the English Electric Co., Ltd., and switchgear by Mr. F. Macdonald of B.T.H. This last-mentioned section of the recorded version incorporates Mr. P. G. Ashley's contribution on bushings. The work finished with an outline of insulation testing in the laboratory, factory and field, by Dr. J. S. Forrest of the Central Electricity Authority Research Laboratories, Leatherhead. Nobody remotely connected with electrical insulation could fail to recognize the authority behind this panel of speakers.—W.D.O.

Dielectric Materials and Applications. Edited by Dr. A. von Hippel. Pp. 438; figs. Chapman & Hall, Ltd. Price 140s.

As evidence that there is nothing parochial or insular in the tendency to lengthen the academic year in the manner indicated in the above review, comes this book from the United States showing just how well they do this kind of thing at the Massachusetts Institute of Technology. Prof. A. von Hippel, not content with having given expression to modern concepts of dielectric behaviour in one of the most comprehensive of textbooks, "Dielectric and Waves," has carried out the onerous task of integrating the subject matter of some twenty-odd lectures on dielectric materials and applications, beginning with an introduction to theory which would fill a small sized textbook as it stands.

Measuring techniques come next, including those for permittivity, permeability, microwave spectroscopy and magnetic resonance. The absence of any reference to breakdown is especially noteworthy. The third part of the book, devoted to materials and their applications, is essentially realistic in its attitude towards generation, distribution, control and use. Had this been more of a hot meal than a cold collation, the transition from stage to stage would perhaps have been less violent, and the sections on cables, capacitors and electronics would have been less assertive. Nevertheless, the American outlook is well revealed thereby and the fact constitutes something of value to those who cater for overseas markets.

The requirements of America's fighting services are appropriately presented by representatives of each branch, and the book finishes with a mass of technical data resulting from measurements made in the M.I.T. Laboratories under carefully controlled conditions.—W.D.O.

Modern Physics for the Engineer. Edited by Louis N. Ridenour. Pp. 499; figs. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 53s 6d in the United Kingdom.

Two years ago an extension course having the same title as this book was held at the University of California, Los Angeles. Its purpose was to familiarize engineers with some of the current advances in physics on the theory that, in our technological society, the physics of to-day is the engineering of to-morrow. The time lag between scientific discovery and engineering application has in recent years been drastically shortened, but not nearly so much as it should be, so it is more than ever necessary for the engineer to be aware of the significant developments in the fields of the physical sciences. The eighteen lectures, each of which was delivered by recognized authorities in the fields treated, are recorded in this book and very interesting reading it makes.

The book is divided into three main sections. The first, under the general heading "Laws of Nature," deals with relativity and the foundations of mechanics, atomic structure, solid physics, magnetism, microwave spectroscopy, nuclear structure and transmutation, electro-nuclear machines, nuclear power, and elementary particles. The second part is entitled "Man's Physical Environment" and it covers astrophysics, high pressure phenomena with application to geophysics, the earth beneath the sea, thunderstorms and lightning strokes, and transient phenomena in supersonic flow. Under the heading "Information and its Communication" the final section is concerned with electrons and waves, semiconductor electronics, communication theory and the transmission of information, and computers and the processing of information.

Altogether the book is remarkably good in spite of the fact that it covers what would appear to be far too wide a field. But it does contain a great deal of relevant data on modern physics which are presented in a most readable manner. Ideally all engineers should have a working knowledge of the contents of this book which we feel is very good value for money. One criticism, however, is that the book tends to give the impression that very little physical research is done outside the United States.—R.P.

BOOKS RECEIVED

Mine Legislation. By W. H. Prothero and J. Worthington. Pp. 112; figs. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 10s 6d.

Electric Railway Engineering. By T. Ferguson, A.M.I.E.E. Pp. 416; figs. 127. MacDonald & Evans, Ltd., 8, John Street, Bedford Row, London, W.C.1. Price 57s 6d.

Automatic Transmissions. Compiled by the instructional staff of the Commercial Trades Institute. Pp. 406; figs. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 49s in the United Kingdom.

RURAL ELECTRIFICATION IN FRANCE

The Provence Co-operative Plan

By DIANA ANLEY

PROVENCE, especially that part which lies in and around the Durance Valley, contains some of the richest growing land in France. The alluvial soil and the favourable climate makes it possible to farm all the year round. In this part of the country, " coopératives " have installed modern machinery too expensive for the individual grower to purchase and Electricité de France has replanned the distribution system in the area.

The flow of the Durance is to be regulated from source to mouth to stop flooding and provide the region, as well as the national grid, with more electricity, subject to the passing of a special Act. The work will commence with the building of the " Serre-Poncon " Dam, which will be the highest earth dam in Europe and the first to be constructed in France. The height of the crest above the river bed will be 394ft. Numerous investigations have been undertaken since as far back as 1895, but owing to the great depth of the alluvial valley, it is only now with improved methods of soil grouting to a depth of 120ft that the scheme has become practicable. Laboratories have been built on site and experiments are being made with local material.

An underground power station will be constructed inside the rock on the left bank. Four Francis turbines, with a total capacity of 320,000 kW, will operate under an average net head of 350ft. Two penstocks dividing into four branches are to be equipped with automatic rapid-closing valves. Also built into the rock will be an underground switch and transformer house. The dam will hold a reserve of approximately 1,200 million cubic metres of water and flooding of the area will necessitate the reconstruction of over nine miles of railroad and fifteen miles of highway. Further hydro-electric stations will be built downstream, and large irrigation canals will branch off over the countryside to ensure an adequate water supply in summer. When the entire scheme is completed it is hoped to obtain an output of electricity in the region of 6,000 million kWh.

Fruit Growing

Nearly all farms in the area have a supply of electricity for domestic purposes, with motors for water pumping. In many cases an additional 3 h.p. motor is installed for carrot washing, log sawing, or grinding. Growers are becoming increasingly interested in soil warming for melons, tomatoes, aubergines, and for very early vegetables.

Numerous fruit co-operatives have a considerable annual electricity consumption. One of them, the " Vergers de Cabannes," which collects all produce from a group of twelve cultivators, handles annually about 2,000 tons of fruit, which consists of peaches, pears, apples, apricots, cherries and grapes for the table, and in the busy season employs 100 women and 18 men.

All rooms are air conditioned. The electricity supply is received from overhead 13 kV lines at a substation on the premises and stepped down to 127 V and 220 V. Plant to a total of 115 h.p. provides refrigeration for the cold storage chambers.

On arrival, the fruit is weighed and left in a pre-refrigeration room for 24 hours. It is then brushed by a 2 h.p. John Bean machine, all dust being collected into sacks by air suction. Placed on a conveyor belt it passes to a sorting machine, which grades it into ten different weights. The fruit is then wrapped, packed, and placed in cold storage at a temperature of 1 to 2 deg C. It is dispatched in special refrigerated vans by rail to all parts of France and abroad. Fruit not to be sold immediately is treated in the same way, but stocked in special cases holding 25 kg in rooms kept at a temperature of 0 to 1 deg C.

The Wine Industry

Alternating with orchards in this part of the country, are vineyards. In connection with these, there are numerous " Caves Coopératives Vinicoles." The " Caves Coopératives Morières " is the most modern. It is built in the form of a circle, allowing six carts to unload at once. The grapes are deposited in a pit and then elevated to a machine for separating the fruit from the stalks. Grapes fall to a vat below where they are pressed and the degree and quantity of juice is measured. This is recorded on a ticket which is handed to the grower. All machinery is electrically operated from a central control panel. According to the operator's assessment of the juice, each vat is tipped either to right or left and its contents pumped through a selection of four pipes to fermentation vats. The power installed amounts to 60 kW.

This co-operative has 355 growers who bring all their grapes for pressing. In 1953, 1,342,000 kg of grapes were handled which gave 10,700 hl of wine.

The " Caves Coopératives de Mazan " which produces the famous " Côteaux du Ventoux " wines employs the same methods, but on a larger scale. The stalks, etc., are removed on conveyor belts to lorries outside the building. With four machines 250 tons of grapes can be treated each day. There are 400 growers and the total capacity is 40,000 hl. These wine co-operatives, which are fairly numerous, can only be regarded as seasonal consumers although their consumption of electricity is considerable.

Not all of this part of the country is given over to fruit and vegetables. Other co-operatives collect, pasteurize, bottle and distribute milk within a radius of 40 km each morning. Here again all machinery is electrically operated.

A large amount of pork also is raised throughout the region. Since 1951 the " Coopérative Agricole d'Abattage de Pelisanne " has become increasingly prosperous. As well as being a slaughterhouse, it specializes in all the products of pork butchery. It has provision for handling 20,000 pigs and 2,000 head of beef per year. At present the daily output is 350 pigs and 35 beef animals.

Pigs are electrocuted humanely by means of tongs placed on either side of the head behind the ears. Falling sideways the carcase is deposited on a table where it is immediately blooded, then immersed in a tank of water heated to 65 deg C, picked up by an elevator and carried to a machine to have the bristles removed. The carcase is then hung on a monorail and dispatched to a room for opening, removing the inside, cleaning, cutting down the middle and then re-weighing. After inspection all meat is placed

in a room with a temperature kept at 12 to 14 deg C. There are two of these rooms, one for pork and the other for beef. After an interval, the sides of pork are taken into another room where the legs, shoulders and heads are separated. Here the skin is separated from the fat by an electrical machine, the fat cut into strips and then diced by another machine. The temperature of this room is maintained at 12 or 13 deg C by water circulation and it is ventilated by two 3 h.p. fans. The adjoining gutting room is equipped with two electric ovens, an electric copper and two 200 litre water heaters. In the kitchen there is a steam cooker for hams, a 5 kW electric cooker, steam coppers and a 14 kW electric oven. Packing and soldering of tins for the hams, etc., is done electrically.

The sausage making department is equipped with a variety of electrical machines. There are two 5 h.p. mixers, three 14 h.p. mincers, four h.p. filling machines, a 2 h.p. scraper and two 4 kW sterilizers. After being made, the different varieties of sausages are placed in a moisture extraction chamber where the temperature is kept at 28 deg C by heating elements embedded in the cement floor. The building has various large drying chambers, cold storage rooms, and curing rooms as well as an ice making plant. Refrigeration for 4,200 cu m of cold storage is provided by five compressor units.

Electricity is supplied at 15 kV by Electricité de France by overhead lines. It is taken to three 200 kVA transformers and then distributed by nine cables at 220 V around the building. Use is made of a tariff which gives preferential rates for off-peak use. As slaughtering takes place at about 4 a.m. each morning this is an advantage. During the year October, 1952, to September, 1953, the consumption was 684,090 kWh.

The history of all these different " coopératives " is one of increasing prosperity. Their administrations conform to the national policy for the development of French agriculture by all the technical and economic means at their disposal. Lower marketing costs must have a beneficial result on retail prices and help to lower the cost of living. It seems almost certain, that as their advantages are realized, the idea will spread to wider areas and become as firmly established as in the United States.

Swiss Electrical Industry

ENGINEERING and watch-making together accounted for about half of Swiss exports during the years 1951 to 1953, according to a report on the economic and commercial conditions in Switzerland* by Mr. L. G. Holliday, formerly Counsellor (Commercial) to H.M. Embassy at Berne, and both branches achieved new records in foreign sales during these years. The order book in engineering was 10 per cent less at the end of 1953 than at the beginning of the year, but as a result of renewed demand for such items as textile machinery, the majority of the firms still had six months' work on hand. With increasing signs that the boom is past, with lower prices, slower orders, shorter delivery dates, and the threat from the expanded machine-making capacity of other countries in Western Europe, particularly Germany, the Swiss engineering industry is beginning to press for support as regards long-term credit. The Swiss authorities, however, maintain that export credit should be self-financing in the future as it has been in the past.

Mr. Holliday's comments on the Swiss electrical manufacturing industry are largely a review of the activities of the Brown Boveri concern, and he mentions some of the more important orders received by that company for generating plant. Swiss exports of dynamo-electric plant were very high though they fell slightly from 122 million Swiss francs in 1951 to 110 million in 1953 (£1 = 12¼ Swiss francs). Foreign competition increased, prices tended to fall and credit periods to lengthen.

Little information is given in the report on the imports of electrical goods from the United Kingdom, the only figures given being for telephone, telegraph and radio instruments and apparatus, the value of which totalled 2·8 million Swiss francs in 1953 and 500,000 francs for the first quarter of 1954, as compared with 2·9 million francs in 1952 and 500,000 francs in 1938. Electrical instruments and apparatus imported from the United Kingdom (other than those already mentioned) totalled 1·1 million Swiss francs in 1953 (300,000 francs in the first quarter of 1954) and 1·1 million francs and 200,000 francs for the years 1952 and 1938 respectively.

* H.M. Stationery Office, 4s 6d net.

Dealing with Swiss electricity supply development, Mr. Holliday gives figures showing the rapid growth of hydro-electric power. The total output from Swiss power stations (including 42 million kWh imported) totalled 7,176 million kWh in 1938-39, of which 7,089 million was produced by hydro-electric power stations. In 1952-53 the total had risen to 13,951 million kWh, of which hydro-electric stations produced 13,407 million kWh. Electricity consumption for the years 1950-51, 1951-52 and 1952-53 is shown in the accompanying table.

Installed capacity at the end of 1952 was 2·95 million kW. In October, 1953, fourteen hydro-electric stations, each of 10 million kWh annual output at least, were under construction. The sharpest increases in consumption were for domestic and workshop use. Between 1950 and 1952 the number of electric cookers in use increased by 14 per cent to 495,000, water heaters by 14 per cent to 482,000, small household motors by 28 per cent to 480,000 and refrigerators by 39 per cent to 116,000.

Electricity Consumption (Million kWh)

Year	Domestic	Railways		Chemical Metallurgical Industry	Other Industry	Electric Boilers	Losses and used by Pumps	Total Consumption in Switzerland	Export
		Federal	Others						
1938–39	1,411	549	173	1,404	819	506	751	5,613	1,563
1950–51	3,770	811	261	2,364	1,797	1,024	1,527	11,554	1,099
1951–52	4,086	842	276	2,540	1,852	787	1,665	12,048	1,202
1952–53	4,421	871	287	2,464	1,894	850	1,665	12,452	1,499

New investment in hydro-electric projects amounted to 280 million Swiss francs in 1950, 350 million Swiss francs in 1951, and 450 million Swiss francs in 1952. By 1961 the total Swiss investment in the production of electricity is expected to reach 7,500 million Swiss francs.

Atomic Energy

Such concerns as Brown Boveri are interested in the development of atomic energy. Dr. Walther Boveri in 1953 made a public proposal to the effect that Swiss industry should raise 20 million Swiss francs for the construction of an experimental reactor. In February last year it was announced that the funds had been subscribed and construction of the reactor was about to start.

GENERATION AND DEVELOPMENT

East Midlands Costs and Tariffs

A warning that if coal prices continue to rise electricity would cost more, was given by Mr. C. R. King, chairman of the East Midlands Electricity Board, in a report to the Consultative Council. Provided present conditions remained unchanged, the Board hoped to avoid any tariff increases during the coming year, despite recent wage awards which had added approximately £400,000 to the Board's costs. The revision of tariffs would, however, have to be seriously considered if costs continued to rise, particularly if there was an increase in the price of coal.

The new bulk supply tariff under which the Board bought its supplies from the Central Authority would remain basically the same, said Mr. King. Increased efficiency of the modern power stations now coming into operation was reflected in the slightly lower price in the final adjustment clause, and modifications had been made to certain of the Board's industrial and commercial tariffs.

A plea for the abolition of purchase tax on all electrical goods, particularly washing machines, was made by Mrs. D. P. Oxenham (Little Haddington). The tax on washing machines she contended was a tax on health. Why should they not take some of the drudgery out of washing day? She urged that representations should be made to the Chancellor of the Exchequer. The Council agreed to present its views on the matter.

Midlands Industrial Charges

A small reduction, taking effect on 1st April, has been made by the Midlands Electricity Board in charges to industrial and large commercial consumers on tariffs containing fuel price adjustment clauses. There is no change in domestic and other tariffs. This follows the reduction in the fuel adjustment charge in the Central Electricity Authority's bulk supply tariff.

Chairman Reviews Board's Progress

Facts on electrical development in the Merseyside and North Wales Area were given to the Consultative Council at its meeting at Chester on 30th March by Mr. D. H. Kendon, chairman of the Board. The average number of new consumers connected in the first five years of the Board's existence was 25,000, he said, and in its seventh year (to 31st March last) the figure had been increased to 30,000. On the same basis the length of new mains put into use had risen from 400 to 650 miles, despite the bad weather throughout the past year, and sales of electricity from 113 million kWh to 400 million.

The increase in electricity consumption for industrial purposes had been rapid—in fact for a while it had outstripped the domestic expansion. During the past year the Board had sold about 100 million kWh more for domestic use than it did two years ago, an increase of 10 per cent, while for industry sales were up by 450 million kWh (25 per cent). It was important that the growth of these two main uses should keep in step as each helped the other by spreading the capital charges and other fixed costs.

During the year, more than 16,000 electric cookers were sold and 12,000 water heaters were connected to the system. A new type water heater would shortly be available which would heat efficiently and quickly a large or small amount of water. It consisted of two heaters in one immerser—one to heat the top of the tank only, and the other when required to heat the whole of the tank—both heaters being controlled by one thermostat and change-over switch. The Board was spending about £4 million a year on capital account, including nearly £1 million on rural supplies and similar amounts on mains for new houses and for new industrial supplies, and on new plant and mains to reinforce the system generally.

Electricity for the Trossachs

Mrs. W. McNair Snadden, wife of the Under Secretary of State for Scotland, switched on the Trossachs electricity distribution scheme on Saturday, 2nd April, at Loch Katrine pier. The scheme makes electricity available to the area between the Trossachs, Brig of Turk, and Kilmahog, near Callander.

Mr. Thomas Johnston, chairman of the North of Scotland Hydro-Electric Board, speaking at the ceremony, said: "Some of the Board's English critics occasionally comment upon what they believe is our high capital cost of construction per kilowatt, and they get their fantastic figures by dividing all our capital expenditure by the number of kilowatts produced. But these commentators fail to notice that we have spent £25½ million not upon generation at all, but upon distribution, and often to remote and sparsely populated areas."

So far as he could ascertain, only the North of Scotland Hydro-Electric Board of all the Electricity Boards in the world carried its rural distribution costs without subsidy in any shape or form from Government funds. Not only was the Hydro-Electric Board electrifying the rural areas without subsidy, but it was meeting its interest and sinking fund charges. Domestic tariffs were lower than those paid by 40 per cent of the population in Britain, while farms and crofts were receiving supplies at slightly lower rates than the average for Britain. That applied also to commercial premises. With the coming of electricity the economy of Scotland was being stimulated and the desolation and despair which had cursed them for a century was being swept away. Their assets were being efficiently marketed and there now was legitimate hope of a prosperous future.

Output in First Quarter

During the first 13 weeks of this year 21,373 million kWh was sent out for public supply from solid-fuel-fired generating stations in this country, according to the latest Ministry of Fuel and Power statistical statement. This compares with 18,884 million kWh in the first quarter of last year and represents an increase of 2,489 million kWh (13·2 per cent).

Power from Snowy Scheme

The first power generated from the Snowy Mountains hydro-electric scheme is now being fed into the New South Wales electricity system. The link-up took place on 21st February. Power generated from a 30,000 kW unit at the Munyang power station at the Guthega Dam is being used to supplement the Electricity Commission's power supplies at times of peak demand.

West Pakistan Power Development

A report of the Federation of British Industries representative in Karachi for the last quarter of 1954 states that the slow pace of power development in West Pakistan, which has retarded several industrial projects, has caused considerable concern and the Government has now decided that responsibility for power development should be entrusted to a separate Power Development Corporation which will be set up in due course. Mr. C. E. H. Verity, deputy chief engineer, Central Electricity Authority, and Mr. Stuart M. Rix, vice-chairman, Southern Electricity Board, recently toured Pakistan for a period of three weeks to study local conditions and advise the Government on the organizational aspects of such a Corporation.

In the meantime, a Central Electrical Commission has been set up and consulting engineers have been appointed for all major thermal and hydro-electric power stations. Messrs. H. G. Acres & Co., of Canada, have been appointed as consultants for the Warsak project, Messrs. Brian Colquhoun of the United Kingdom for Karachi power station and Messrs. Merz & McLellan for the Hyderabad power station (Sind).

There has been a reassessment of power requirements of the country and the best means of meeting them. This has been necessitated mainly by the

discovery of gas at Sui and Messrs. H. G. Acres have been entrusted with the task of carrying out the survey. It is understood that they will recommend that the capacity of the Warsak project shall be stepped up from 150,000 to 240,000 kW. It is proposed to take a second pipe line from Sui to Kot Addu in the Punjab, and set up there a central power plant to meet the requirements of the Lower Punjab and Bahawalpur. Implementation of this scheme has been entrusted to the Pakistan Industrial Development Corporation, which has engaged Messrs. Montecatini of Italy to prepare a project. With these two additional sources of supply in the Punjab, it is understood that the necessity for the Mianwali project is being reviewed.

Submarine Cable Laying

An unusual method of laying a submarine power cable was adopted by W. T. Henley's Telegraph Works Co., Ltd., in carrying out a recent contract for the Nabadwip Electric Supply Company, Bengal. A length of 1,358 yd of 0·0225 sq in, 11 kV, three-core impregnated paper insulated, lead covered, double wire armoured and served submarine cable was supplied by Henley's to connect an 11 kV overhead line to an outdoor substation. The terminal structure of the line is on the Nabadwip Ghat side of the River Bhagirathy while the terminal structure of the substation at which the line connects is situated on the Nabadwip Cham bank opposite.

No facilities were available on site for handling the very heavy drum if the cable had been made and delivered in a single length. Three drums were therefore supplied, two of 567 yd and one of 225 yd; these lengths were decided by the positions suitable for constructing the straight-through joints.

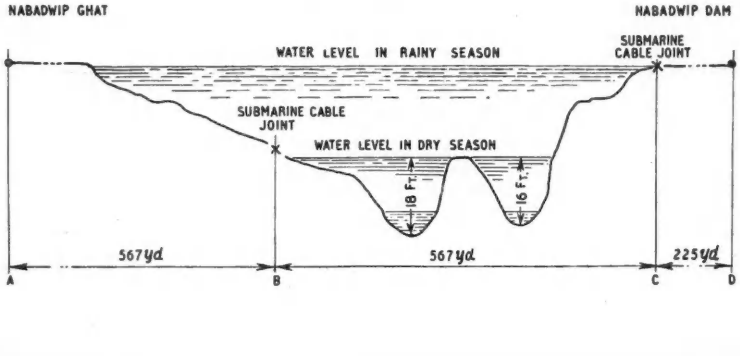
The accompanying sketch of the river bed along the cable route shows a shallow bank at the centre. This bank is exposed during the dry season and the cable-laying operations were planned to take place when the river was at a low level to facilitate the construction of the joints and to ensure that the cable could be properly buried at all parts of the route subject to exposure during the dry season.

No suitable craft was available in the district on which a cable drum could be mounted and the cable paid off in the usual way. Alternative means were, however, ready at hand. Nabadwip is a place of pilgrimage and as no bridge crosses the river, hundreds of small boats ply carrying pilgrims and villagers across the river.

It was easier to enlist the services of 127 of these small boats than it was to marshal them into position and to secure them to form a temporary bridge across the river. They were, however, eventually moored in position at 10ft intervals and cable rollers were secured to the boats. One of the 567 yd lengths of cable, the section between B and C in the sketch, was mounted at the top of the steep bank at C in line with the "bridge" and on the opposite river bank a winch was fixed for hauling off the cable. Once the boats were secured in a reasonably straight line, and at the required distance apart, the actual hauling-off of the cable proceeded smoothly without a hitch, this operation taking about three hours. The running end of the cable was then firmly anchored and the cable progressively removed from the rollers and lowered on to the river bed. The cable remaining on the rollers was, of course, free to move, thus providing the necessary slack for lowering the cable. On completion of this work the cable was buried deeply in the sand on the exposed banks.

To lay the other two lengths of cable was a straightforward trenching job, except, of course, where the cable had to be secured to the overhead line and substation structures, on which the sealing ends are mounted. The jointing of the submarine type straight-through joints and the sealing ends to complete the cable link were also more or less normal routine tasks.

Contour of the route of the 11 kV submarine cable crossing the River Bhagirathy at Nabadwip, Bengal



STREET LIGHTING NOTES

Fluorescent lighting is to be installed at BALLYMONEY, Northern Ireland. The cost is estimated at £5,000.

The following new works have been included in the street lighting estimates for the city of BATH:—Queen Square, Queen's Parade, Gay Street (£1,447); George Street (£403) and Pulteney Street (£1,820).

BLACKBURN Corporation is recommended to seek sanction to borrow £8,210 for improving the street lighting from Salford to the borough boundary at Wilpshire.

DUDLEY Town Council is recommended to convert the whole of the gas street lighting in the borough to electricity.

EXETER Lighting Committee has approved proposals for the improvement of the lighting of a number of main street at an estimated cost of £17,308.

HODDESDON (Herts) U.D.C. is to improve the lighting in a number of roads at an estimated cost of £8,400.

LEEK (Staffs) U.D.C. has approved a scheme for the conversion of lighting from gas to electricity in Broad Street and Brook Street, at an estimated cost of £2,700.

NORTON - RADSTOCK U.D.C. has accepted a quotation of £10,679 from the South Western Electricity Board for sodium street lighting in the Radstock area.

Fluorescent street lighting has recently been installed in a number of Group "B" roads at PORTADOWN, Northern Ireland. "Mazda" 2ft lanterns, each housing two 40 W lamps, are mounted at an angle of 45 deg on 15ft Avenue 2D concrete columns.

PRESCOT General Purposes Committee proposes to ask Liverpool Corporation to install sodium lamps in St. Helens Road, Prescot, as it is felt that the type of lighting should be similar to that already used on the trunk road through Prescot.

RAMSGATE Corporation is recommended to approve schemes for the conversion of street lighting in 12 streets from gas to electricity, at an estimated cost of £12,370.

ROMFORD Corporation has approved a scheme for the provision of Class A sodium lighting in Havering Road, Orange Tree Hill, North Road and Hog Hill Road.

SURBITON Council is to obtain tenders for the lighting of the whole of the Kingston by-pass road within the borough.

WALSALL Corporation proposes to erect mercury vapour lamps in certain unclassified roads in the borough at a total estimated cost of £11,200.

Improved lighting of the centre of WOKING and the main road through Byfleet and and West Byfleet is estimated to cost £20,000.

Financial Section

STOCKS and SHARES

MOST of the matters which ordinarily dictate the course of Stock Exchange prices have tended to become increasingly overshadowed by the approach of next Tuesday's Budget, with the bigger unknown of a General Election beginning to take shape behind it. So far as the Budget is concerned, it is safe to say that markets have been entertaining no extravagant ideas of tax remissions, despite the magnitude of the surplus at the Chancellor's disposal. By way of a guide to City opinion about the Election prospects, a barometer of sorts is provided by the market in the steel company shares which have been returned, this year and last, to private ownership, and which could apparently be threatened with re-nationalization in the event of a change of Government. In this connection it was noted that prices for such shares as Dorman Longs, Stewarts & Lloyds and United Steels hardened after news of the County Council election results.

Enfield Rolling Mills

Enfield Rolling Mills £1 shares were marked up 13s 6d, to 58s 6d, immediately after publication last week of one of the best set of results received to date in this season of company dividend and profits statements. Some recovery from the relatively low level of 1953 profits had been expected, but anticipations had not been prepared for the doubling of the net surplus, at £588,000, and also of the rate of the ordinary dividend at 20 per cent. The latter, which represents the fifth increase in succession, appears to remain well within the amount available for distribution, and brings the yield on the shares at the enhanced price to 6 per cent.

A. Reyrolle Dividend

The Reyrolle results published at the beginning of this month seem to have been well up to expectations, for there was a subsequent hardening of the quotation for the £1 shares at 95s. (They stood at 105s before the general market recession set in two months ago.) With the rate of the dividend raised from 13¾ (excluding a special tax-free payment of 2½) per cent to 15 per cent, the return on the shares is still moderate at 3¼ per cent, but the expansion of earnings shown in the latest preliminary statement keeps the dividend in its place as one of the most conservative payments in the industrial list. Relieved this time of the excess profits levy, the net surplus is higher by some 40 per cent at £1,647,000 (after tax of £1,519,000), of which sum it may be estimated that net ordinary and preference dividends together will involve the distribution of only about one-sixth.

Lancashire Dynamo

Lancashire Dynamo £1 ordinary shares attracted good support after the company's announcement of increased earnings and dividends for 1954, and of the intention to distribute a one-for-two script issue. At a fraction over £3, the price of the shares came level with the year's peak: few shares in the industrial market are at present near to that distinction. The final dividend now declared brings the total to 15 per cent, as compared with the previous payment of 14 per cent, which included 1½ per cent as bonus. Earnings of £256,000 after tax, are up by approximately 11 per cent. Yield on the shares now works out to 5 per cent.

Decca New Shares

Among ordinary shares currently transferable free of stamp duty are Decca Record's new 4s "A" shares, distributed to stockholders by way of a scrip issue in the proportion of one for every two old ordinary shares held. (In these cases, as opposed to issues of new stock for cash, the freedom from stamp duty is usually allowed for, at least partially, in the price.) These new shares, which rank equally with the old except in that they carry no voting rights, have been quoted lately at 35s. The dividend of 56¼ per cent paid for the year to March, 1954, would give the equivalent of 37½ per cent on the ordinary capital as now increased, and on that basis the yield on the shares would be 4¼ per cent. Speaking at the annual meeting in February, with the best part of another twelvemonth already completed, the chairman declared the company to be assured of another very successful year's trading.

Free of Stamp

Several recent electrical company issues are being dealt in at the moment in allotment letter form, and therefore free of the usual 2 per cent transfer stamp duty. Since the latter adds the equivalent in some cases of almost a year's net income to the cost of buying securities, many investors are glad of the opportunity to deal on these terms. Among the stocks still available "free of stamp" is the G.E.C. 4 per cent unsecured loan stock, redeemable 1975/80, which can be bought at about 96 to yield just on 4¼ per cent. Offered originally at 97½, this was one of the issues to be caught up in the market disturbance caused by the February increase in Bank Rate. The Electric & Musical Industries issues made in the same circumstances are also still available in stamp-free form, and will remain so until the beginning of next month. The 4½ per cent unsecured loan has been standing at a fraction under 100, and the 5½ per cent cumulative preference shares at 19s 6d.

Engineering & Lighting

The 2s ordinary shares of the Engineering & Lighting Equipment Co. are now quoted ex the scrip issue of three new shares for every two held. Early dealings in the new shares took place up to 6s, with the old a few pence lower. The company's financial year ended in March. Last time a single dividend declaration was made early in June. On that occasion the company was able to report the doubling of both the net profit, to £85,000, and of the ordinary distribution to 30 (including bonus of 10) per cent, this payment being covered as much as five times by the distributable surplus. Last October an interim dividend of 15 per cent was declared, together with a statement that trading and financial results for the first six months of the year now ended were very satisfactory. On the basis of last year's distribution, adjusted for the scrip issue now in progress, the yield on the new shares is about 4 per cent.

Company News

Hoover 5s shares were a firmer market at around 47s 6d after the annual meeting held at the beginning of the month, when the chairman reported that turnover in the first eleven weeks of this year had been 21 per cent above the record level established in the corresponding period of 1954. Significantly, the best week at home for all time occurred two weeks after the reimposition of the hire-purchase restrictions. The annual report to be presented at the Bylock Electric annual meeting next Friday (22nd April) shows a rise in the net taxed profit from £4,000 to £20,000, and in the ordinary dividend from 20 to 33⅓ per cent. A statement by the chairman describes the position regarding forward orders as very healthy. At 3s 6d the 1s ordinary shares offer a return of 9½ per cent.

Because of the Easter holiday our usual table of electrical investments is omitted; publication will be resumed next week.

Radio Industry Training

The first of the students who entered three-year technical training courses started in 1952 are now about to enter the radio industry. The courses were organized by the Ministry of Education, following consideration of training problems by the Radio Industry Council's Technical Training Committee and the Radar Sub-Committee of Lord Hankey's Technical Personnel Committee, at five London and provincial centres. The object of the courses is to provide students so well trained in the theory and practice of electronics that they will be able, on completion, to take their places at once as assistants to qualified research and development engineers.

Reports and Dividends

Telephone Properties, Ltd., reports a net profit for 1954 of £48,038, as compared with £35,252 for 1953. Taxation charged was £73,000. It is proposed to pay a first and final dividend of 20 per cent on £272,355 ordinary stock (against 8 per cent on £410,932). The balance carried forward is £87,245, an increase of £5,384.

G. & J. Weir, Ltd.—The net profit for 1954, after deducting £1,530,430 for taxation, is £1,534,486, as compared with £804,269 for the preceding year. It is proposed to pay a final dividend of 20 per cent, making 27½ per cent for the year (against 21 per cent).

The British Engine Boiler & Electrical Insurance Co., Ltd., reports an income from premiums, etc., of £2,589,688 for 1954 and claims and other outgoings of £2,194,983. After providing for unexpired risks, the profit is £320,689 (against £274,232). It is proposed to pay a final dividend of 27½ per cent, making 55 per cent for the year (against 50 per cent). The balance carried forward is £323,150 (against £246,937 brought in).

McMichael Radio, Ltd.—After providing for taxation, the net profit for 1954 is £39,075, as compared with £28,529 for 1953. It is proposed to pay a dividend for the year of 12 per cent (10 per cent) on the participating preferred ordinary capital and 16¾ per cent (12⅜ per cent) on the ordinary.

New Companies

Electronic Supplies (Huddersfield), Ltd. — Registered 14th February. Capital £1,000. The first directors are not named. Solicitors: John Sykes & Co., Huddersfield.

Heir Cresswell & Co., Ltd.—Registered 10th February. Capital £2,000. Manufacturers and importers and exporters of and dealers in electric motors, pumps, dynamos, magnetos, etc. Regd. office: 3-4, Berners Street, London, W.1.

William Camm & Co., Ltd.—Registered 16th February. Capital £100. Electrical engineers and contractors, etc. Directors: W. G. Camm and D. F. Camm. Regd. office: 12, Middle Pavement, Nottingham.

V. L. Martin & Co., Ltd.—Registered 16th February. Capital £3,000. To acquire the business of an electrical engineer carried on by Vincent L. Martin at 34-36, High Street, Southall, Middx. Directors: V. L. Martin and Margaret Martin. Regd. office: Central Hall Buildings, South Road, Southall, Middx.

Dawsons (Bournemouth), Ltd.—Registered 17th February. Capital £2,000. To acquire the business of an electrical and mechanical engineer now carried on by Howard Dawson at Midland Road, Winton, Bournemouth, as Dawsons of Bournemouth. Directors: H. Dawson and Pearl H. Dawson. Regd. office: 1-2, Sandringham Mansions, Exeter Road, Bournemouth.

Cathora, Ltd. — Registered 17th February. Capital £100. Electricians, radio, television and electrical engineers, etc. Directors: R. R. Bell, Mrs. Doris I. Bell and J. F. Archer. Regd. office: 44, Bavaria Road, N.19.

T/Vert, Ltd. — Registered 18th February. Capital £100. Radio and television engineers, etc. Directors: S. A. Salter and C. J. Salter. Regd. office: Bank Chambers, 512-514, Brixton Road, S.W.9.

Edy (Great Britain), Ltd.—Registered 21st February. Capital £1,000. Manufacturers of and dealers in washing machines, spin drying machines, floor polishers, vacuum cleaners, etc. Directors: F. Horn and S. Croudson. Regd. office: Farnley Low Mills, Worley, Leeds, 12.

W. H. Battarbee (Electrical Contractors), Ltd.—Registered 1st February. Capital £1,000. Directors: W. H. Battarbee, Betty I. Battarbee, G. S. Battarbee and J. Firth. Regd. office: The Mansion House, Dartmouth.

A. & D. C. Electrical Equipment Co., Ltd.—Registered 4th March. Capital £2,000. Directors: S. R. Bates, Mrs. Annie V. D. Bates and R. C. K. Bates. Regd. office: Woodlands, Greensted Green, Ongar, Essex.

Street Lanterns, Ltd.—Registered 16th March. Capital £100. Manufacturers of and dealers in all apparatus and appliances used in connection with the electrical lighting of streets and roads, etc. Mrs. Pauline Cutler, 29, Redburn Avenue, Whitecraigs, is the first director.

Thames Valley (Telecare & Maintenance), Ltd.—Registered 16th March. Capital £5,000. General maintainers and repairers of radio and television, etc. Directors: W. J. Smith (permanent) and Mrs. Flora B. Smith. Regd. office: 70, High Street, Whitton, Middx.

Bankruptcies

C. G. Carder, 2, Bone Hill, Buckingham, electrician.—First meeting 21st April at 58-61, York Terrace, Regent's Park, London, N.W.1. Public examination 15th June at the County Hall, Aylesbury.

F. W. Bedingfield, 49, High Street, Folkestone, radio and electrical engineer.—Order made 8th March granting discharge as from 22nd March.

S. I. Chapman, carrying on business as S. Chapman & Co. at 103, Endsleigh Court, London, W.C.1, electrical agent.—Trustee, Mr. W. F. Cresswell, Bankruptcy Buildings, Carey Street, London, W.C.2, released 31st March.

Sweden's Electrical Trade

Features of Sweden's external electrical trade last year were an increase of roughly 15 per cent in both imports and exports and an excess of imports over exports of Kr.23 million. At the same time rather less power plant was purchased from abroad and more sold abroad than in 1953. In the export field there was also a noteworthy advance in vacuum cleaners and a moderate increase in telegraph and telephone apparatus, this group being the most valuable in the list.

Sweden's leading customer was Norway with nearby countries not far behind; farther afield Mexico, Brazil and Colombia were good outlets, while Poland and Soviet Russia made moderate purchases.

Germany (with Kr.153 million out of the total of Kr.352 million) was Sweden's chief supplier of electrical equipment, followed by Britain (Kr.53 million) and the Netherlands Kr.52 million. The accompanying table gives the values of the chief groups in 1954 with notes of increases or decreases on 1953. (Kr.14·5 = £1.)

Class of Equipment	IMPORTS		EXPORTS	
	1954 Kr. (000)	Inc. or dec. on 1953 Kr. (000)	1954 Kr. (000)	Inc. or dec. on 1953 Kr. (000)
Generators, motors, convertors, etc.	57,947	− 9,306	60,098	+ 7,25
Vacuum cleaners, fans, etc.	41,588	+ 6,923	39,432	+ 9,07
Stators, rotors, current collectors, etc.	7,815	+ 1,631	2,517	+ 44
Accumulators	3,115	+ 1,132	18,285	− 95
Battery parts	4,406	+ 441	—	—
Lamps, incandescent	8,789	+ 3,725	840	− 20
Lamps, other	16,890	+ 4,347	—	—
Carbons for electrotechnical purposes	10,826	− 1,364	777	+ 25
Starting, regulating, control and switch apparatus	27,941	− 319	20,010	+ 2,65
Porcelain insulators	1,611	+ 157	—	—
Cable, metal-clad	22,653	+ 7,831	9,838	+ 2,11
Cable, other	11,024	+ 2,689		
Electric stoves, fires, etc.	3,552	+ 1,293	2,859	+ 48
Electric meters	12,404	+ 3,068	3,170	+ 19
Telegraph and telephone apparatus	2,233	− 1,315	100,436	+ 14,53
Radio apparatus, valves, etc.	43,845	+ 14,229	14,385	− 60
Electro-medical apparatus and special electro-technical apparatus	75,677	+ 9,736	51,342	*
Rontgen tubes	1,657	+ 430	533	− 12

* Comparative figures not available.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 18th April

BIRMINGHAM.—Grand Hotel, Colmore Row, 6.15 p.m. Birmingham Electric Club. "Heavy Haulage and its Ancillary Work," by E. Bulgin.

DUNDEE. — Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. "The Factories Acts, 1937 and 1948, as they affect the Plant Engineer," by R. E. Griffith.

IPSWICH. — Electric House, 7.30 p.m. Ipswich & District Electrical Association. "Modern Methods of Heating Buildings," by J. R. Harrison.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers, informal meeting. Discussion on "Domestic Circuits and Protection Devices," opened by H. W. Swann.

NEWCASTLE-UPON-TYNE. — Royal Station Hotel, 6.15 p.m. I.E.E. North-Eastern Centre. Annual general meeting, followed by conversazione (7 for 7.15 p.m.).

STAFFORD.—Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre. Short papers evening. (Joint meeting with the North Staffordshire Students' Section.)

WORCESTER.—Hylton Road Club. I.E.E. South Midland Centre. District meeting. "Britain's Atomic Factories," by K. E. B. Jay.

Tuesday, 19th April

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "Problems of Hydro-Electric Design in Mixed Thermal—Hydro-Electric Systems," by T. G. N. Haldane and P. L. Blackstone.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "A Brushless Variable Speed Induction Motor," by Prof. F. C. Williams and E. R. Laithwaite.

LIVERPOOL.—9, The Temple, 24, Dale Street, 6.30 p.m. I.E.S. Liverpool Centre. "Modern Developments in Discharge Lighting," by H. G. Jenkins.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements Section. Discussion on "The Measurement of Impulse Voltages and Currents with special reference to the Testing of Surge Diverters," opened by R. Davis.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Benevolent Association. Golden jubilee luncheon.

At the Institution of Electrical Engineers, Savoy Place, 6 p.m. Illuminating Engineering Society. "Electro-luminescence," by H. C. Bate and J. N. Bowtell.

At the Lighting Service Bureau, 2, Savoy Hill, 6.30 p.m. Association of Supervising Electrical Engineers. London National Lecture: "Electronic Flash in Photography."

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Students' Section. Annual general meeting, followed by "Air Cleaning by Electricity," by A. R. Petheram.

Tuesday, 19th April, to Thursday, 21st April

LONDON.—Grosvenor House, Park Lane. Radio & Electronic Component Manufacturers' Federation Show. (Official opening 11 a.m. 19th April; luncheon at 12.30 for 1 p.m.)

Wednesday, 20th April

DARTFORD.—Littlebrook Generating Station, 2.30 p.m. E.I.B.A. Kent Branch. General meeting followed by a tour of the station.

GLASGOW. — 425/427, Sauchiehall Street, 7 p.m. Incorporated Plant Engineers, Glasgow Branch. "Industrial Electrical Installations," by F. Jones.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. "A Study of the Long-Term Emission Behaviour of an Oxide Cathode Valve. Part I: Emission Behaviour of an Oxide Cathode on a Platinum Core. Part II: Emission Behaviour of an Oxide Cathode on Passive and Active Nickel Cores," by Dr. G. H. Metson.

Café Royal, Regent Street, W.1, 6.45 for 7.15 p.m. Illuminating Engineering Society. Annual dinner-dance.

Waterloo Bridge House, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Acceptance Testing of Auto Exchange Equipment," by L. G. Tite.

ROCHESTER.—Bull Hotel, 7 p.m. Incorporated Plant Engineers, Kent Branch. "Theory and Practice of Earthing Electrical Equipment," by W. J. Jones.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. Annual general meeting, followed by "Sixty-Three Years Electrical Engineering in Sheffield," by W. E. Burnand.

SOUTHAMPTON.—Polygon Hotel, 8.15 p.m. A.S.E.E. Southampton Branch. "Talking Pictures," by T. Dodman.

Thursday, 21st April

BRISTOL.—I.E.E. Bristol Students' Section. Visit to B.B.C. Studios, Whiteladies Road, at 7.30 p.m.

LIVERPOOL.—Riversdale Technical College, Riversdale Road, 7 p.m. British Institution of Radio Engineers, Merseyside Section. Annual general meeting, followed by technical films.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers, ordinary meeting. Kelvin Lecture: "Transistor Physics," by Dr. W. Shockley.

British Electrical & Allied Manufacturers' Association. Annual luncheon (12.30 for 1 p.m.), followed by annual general meeting.

Connaught Rooms. Diesel Engine Users' Association. Annual luncheon.

WATFORD.—Clarendon Hotel, Station Road, 8 p.m. A.S.E.E. Watford Branch. Lecturettes.

Friday, 22nd April

BIRMINGHAM. — Regent House, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "The Design and Application of Flameproof Lighting Equipment," by D. A. Strachan.

At the Birmingham & Midland Institute, Paradise Street, 7.30 p.m. Institute of Welding, Birmingham Branch. "High Frequency Heating," by K. A. Zandstra.

BRISTOL.—Royal Hotel, 6.15 p.m. I.E.S. Bath & Bristol Centre. Annual general meeting.

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "Technical Training in North-West Germany," opened by Dr. K. R. Sturley.

Palmerston Restaurant, Bishopsgate. E.P.E.A. Southern Meter Engineers' Group. Annual dinner.

Pepys House, 14, Rochester Row, 7 p.m. Junior Institution of Engineers. "Some Preliminary Notes on the 'Electronic Brain' in the Automatic Factory," by W. J. Kease.

Saturday, 23rd April

LONDON.—I.E.E. London Students' Section. Visit to G.P.O. Radio Terminal, Brent, at 10 a.m.

A.S.E.E. North-West London Branch. Theatre and supper party.

OXFORD.—Y.M.C.A., 10, George Street, 6.30 p.m. A.S.E.E. Oxford Branch. "Industrial Electronic Control," by C. J. Teece.

DANISH ELECTRICAL TRADE

In Denmark's electrical import trade last year Germany further improved her position. Her supplies were valued at Kr.42,834,000, compared with Kr.34,808,000 in 1953. The United Kingdom took the next place with Kr.27,754,000 (Kr.22,158,000), while Sweden, Holland and Switzerland were active competitors.

Total electrical imports stood at Kr.149,620,000, an increase of about a fifth on 1953, the only notable exception being a decrease in the telegraph and telephone group. Exports, at Kr.171,480,000, expanded by about one-third, with no outstanding shrinkage. Leading customers were Sweden, Norway, Holland and Finland. The chief items in 1954 with notes of increases or decreases on 1953 are shown in the accompanying table (Danish Kr.19·35 equals £1).

Class of Goods	IMPORTS		EXPORTS	
	1954 Kr. (000)	Inc. or dec. on 1953 Kr. (000)	1954 Kr. (000)	Inc. or dec. on 1953 Kr. (000)
Dynamos, motors, convertors, etc.	33,373	+ 13,816	30,529	+ 777
Battery parts	1,629	+ 482	15,014	+ 2,103
Incandescent lamps	9,018	+ 1,790	297	— 93
Radio transmitters and navigation apparatus	11,057	+ 1,026	5,078	+ 260
Radio reception equipment	693	— 1,171	3,824	— 68
Radio valves	3,042	— 37	96	— 88
Parts for radio receiving sets	5,633	+ 1,836	17,266	+ 6,536
Telegraph and telephone material	10,429	— 12,780	2,510	+ 1,130
Electrical appliances for motor vehicles, aircraft, etc.	16,689	+ 8,044	893	+ 325
Cable and wire	5,004	+ 1,296	12,886	+ 834
Electrical heating apparatus	4,693	+ 616	2,083	+ 1,027
Vacuum cleaners and other portable electrical tools and appliances	5,331	+ 2,704	12,185	+ 3,013
Electrical measuring, control, signalling and alarm apparatus	6,971	+ 2,228	10,223	+ 1,932
Electromedical and Röntgen apparatus	5,035	+ 1,404	3,555	+ 694
Electrical material, unspecified	31,023	+ 4,945	55,041	+ 15,351

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 18th May from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

22039. Simplex Electric Co., Ltd.—Electric thermostats. 22nd September, 1952. (730006.)

22875. Simplex Electric Co., Ltd.—Culinary mixing machines. 29th September, 1952. (730007.)

30437/8. Mullard Radio Valve Co., Ltd.—Electric discharge tubes. 16th and 18th March, 1953. (730092/3.)

1952

5662. Sylvania Electric Products, Inc.—Lead-in wire orienting apparatus for electric lamps, discharge devices, and the like. 4th March, 1952. (730012.)

6169. General Electric Co., Ltd., and Platt, A. D. B.—Electrically propelled vehicles. 10th March, 1953. (730013.)

6836. British Thomson-Houston Co., Ltd.—Electric insulating materials. 17th March, 1952. (730289.)

12737. General Electric Co., Ltd., and Williams, C. E.—Circuit arrangements for operating electric discharge lamps having heatable electrodes. 14th August, 1953. (730024.)

13415. Reyrolle & Co., Ltd., A.—Electric relay devices. 15th May, 1953. (730025.)

15674. Elliott Bros. (London), Ltd.—Electronic amplifying circuits. 22nd June, 1953. (730028.)

18515. Compagnie des Machines Bull.—Electronic comparator for two numbers. 22nd July, 1952. (730297.)

18530. Standard Telephones & Cables, Ltd.—Electric gaseous discharge tubes. 23rd July, 1952. (730033.)

19263. General Electric Co., Ltd., Hanson, W. H., and Ward, E. W.—Protective arrangements for a.c. circuits. 3rd July, 1953. (730202.)

19356. Electric & Musical Industries, Ltd.—Electric air heating and circulating apparatus. 31st July, 1953. (730299.)

19562. Associated Electrical Industries, Ltd.—Electron microscopes. 15th July, 1953. (730203.)

19697. General Electric Co.—Cathode-ray tubes. 5th August, 1952. (730204.)

22758. Metropolitan-Vickers Electrical Co., Ltd.—Detection of flaws in non-ferrous metal articles. 27th August, 1953. (730302.)

25791. Process Control Gear, Ltd.—Electric immersion heaters and thermostats therefor. 14th July, 1953. (730216.)

25993. Londex, Ltd., and Stern, W. L.—Electromagnetic flashing devices. 16th October, 1953. (730307.)

26630. Airtron, Inc.—Waveguide switches. 23rd October, 1952. (730219.)

28160. Wild-Barfield Electric Furnaces, Ltd.—Inductors for induction heating. 5th November, 1953. (730104.)

30294. Revo Electric Co., Ltd.—Directional lighting units for aircraft runway systems. 23rd February, 1954. (730227.)

30971. Titan Co., Inc.—Electrolytic cells. 5th December, 1952. (730057.)

32024. Main, Ltd., R. & A.—Thermostatically controlled valves. 17th December, 1953. (730232.)

32083. Wright Electric Motors (Halifax), Ltd., and Franke, L. P.—Electric generators. 18th December, 1953. (730059.)

32200. Allgaier Werkzeugbau Ges.—Wind power plants. 19th December, 1952. (730060.)

32503. Standard Telephones & Cables, Ltd.—Electric trigger circuits. 8th May, 1953. (730061.)

1953

470. Westinghouse Electrical International Co.—Apparatus for controlling the supply of current from a polyphase source of a.c. to a load such as electric welding apparatus. 7th January, 1953. (730064.)

563. Adams & Benson, Ltd.—Electric insulators. 8th January, 1954. (730065.)

784. Warburton, F. E., and Huggett, P. T.—Combined lamp indicator and non-locking electric key switch. 23rd December, 1953. (730066.)

1176. General Motors Corporation.—Electromagnetic acoustic signal devices. 15th January, 1953. (730315.)

1244. Centre National de la Recherche Scientifique.—Electric precision comparators. 15th January, 1953. (730316.)

5450. Bendix Aviation Corporation.—Electrical connectors. 26th February, 1953. (730070.)

7976. Sigma Instrument Co., Ltd.—Electrical linear-dimension gauging instruments. 23rd March, 1953. (730333.)

9153. General Electric Co.—Thermal insulation. 2nd April, 1953. (730114.)

9280. Telefunken Ges für Drahtlose Telegraphie Ges.—Piezo-electric crystal holders provided with electrical heaters. 2nd April, 1953. (730246.)

9679. Metropolitan-Vickers Electrical Co., Ltd.—Control arrangements for d.c. electric motors. 31st March, 1954. (730115.)

10418. General Electric Co.—Electric switches. 16th April, 1953. (730116.)

11182. Singer Manufacturing Co.—Mounting for an electric power transmitter. 23rd April, 1953. (730117.) 11183. Air cooled electric clutch-brake driving device. 23rd April, 1953. (730118.)

11739. Steatite Research Corporation.—Magnetic cup core for inductances. 28th April, 1953. (730120.)

12350. Benchemoul, N. R.—Electric circuit-breaker devices. 4th May, 1953. (730346.)

12912. Standard Telephones & Cables, Ltd.—Tunable coaxial line resonator. 8th May, 1953. (730080.)

13071. Philips Electrical Industries, Ltd.—Circuit arrangements and discharge tubes for high-frequency amplification. 11th May, 1953. (730252.)

14822. Radio Corporation of America.—Fabricating semi-conductive devices. 27th May, 1953. (730123.)

14938. Vigren, S. D., Broberg, W. O. W., and Zander, R. A.—Electric switching devices having spring contact members. 28th May, 1953. (730125.)

15538. Lip Soc. Anon. d'Horlogerie.—Electric clocks. 5th June, 1953. (730128.)

15725. General Electric Co.—Insulated panels. 8th June, 1953. (730127.)

18160. General Electric Co.—Nickel base alloys. 30th June, 1953. (730133.)

18257. Soc. Generale d'Appareillage Electrique.—Washing machines. 1st July, 1953. (730354.)

18943. General Electric Co.—Resistance elements. 8th July, 1953. (730355.)

18981. Sarazin, J. L., Fracchia (nee Sarazin), S. A., and Moneyron, M.—Electrodes for arc welding. 8th July, 1953. (730137.)

21168. General Electric Co.—Insulating structures. 30th July, 1953. (730146.)

22047. Siemens & Halske Akt.-Ges.—Magnetically operated apparatus in traffic control systems. 10th August, 1953. (730359.)

22138. General Electric Co.—Clothes wringers. 11th August, 1953. (730360.)

22909. Bendix Aviation Corporation.—Reciprocating electromagnetic motor. 19th August, 1953. (730151.)

23713. British Thomson-Houston Co., Ltd.—Electric discharge lamps. 27th August, 1953. (730264.)

24756. Bosch Ges., R.—Bowls, more particularly mixing bowls for electrically-driven household kitchen appliances. 8th September, 1953. (730156.)

24757. Bosch Ges., R.—Electrically-driven household kitchen appliances. 8th September, 1953. (730157.)

26928. Fabbrica Milanese Conduttori Soc. per Azioni.—Screened twin electric cables. 1st October, 1953. (730159.)

27063. Standard Telephones & Cables, Ltd.—Titanium nitride electrolytic condenser. 2nd October, 1953. (730160.)

27542. Philips Electrical Industries, Ltd.—Lecher-line systems. 7th October, 1953. (730266.)

32208. Westinghouse Electric International Co.—X-ray apparatus. 20th November, 1953. (730168.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned:—

23rd April

VENT-AXIA. No. 730,750, Class 9. Air filtering, air circulating and air pumping apparatus, all for scientific purposes.—Vent-Axia, Ltd., 116, Putney Bridge Road, London, S.W.15.

TELE VET (design). No. B734,145, Class 9. Testing instruments for television apparatus.—Airmec, Ltd., Cressex Works, Cressex, High Wycombe, Bucks.

STENOMATIC. No. 734,466, Class 9. Radio and television apparatus, gramophones, radiogramophones, apparatus for reproducing and recording sound, loudspeakers, microphones, gramophone pick-ups, electric relays, electric measuring apparatus and instruments, valve amplifiers, electric switches and parts.—Grundig (Great Britain), Ltd., Kidbrooke Park Road, London, S.E.3.

ADVERLITE. No. 736,238, Class 9. Electrically actuated luminous advertising signs.—Glenham Products, Ltd., Quadrex House, Park Lane, London, W.1.

SESAME. No. 738,390, Class 9. Electrical apparatus for operating doors and parts.—Andrew Wise, Ltd., 25, London Road, Southend-on-Sea.

FORTIPHONE MONOCELL. No. 731,140, Class 10. Hearing aids for the deaf.—Fortiphone, Ltd., Fortiphone House, 247, Regent Street, London, W.1.

30th April

SUMMIT. No. 732,095, Class 7. Electric food mixing machines and electric hair drying machines. SUMMIT. No. 732,096, Class 11. Electric hair drying apparatus (not machines), electric toasters and electric oil-filled radiators (space heaters).—Sloan Electrical Co., Ltd., 31-33, Bondway, Vauxhall, London, S.W.8.

STERLING (design). No. 712,685, Class 9. Insulated electric wires and electric cables.—Sterling Cable Co., Ltd., Sterling Works, Aldermaston, Berks.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—26th April. Department of Public Works, New South Wales. Electrically driven pumping plant, etc., for Tathra water supply. (E.S.B. 7100/55. Ten/13238.)*

9th June. State Electricity Commission of Western Australia. One d.c. equipment for Bunbury Generating Station. (E.S.B. 7450/55. Ten/13294.)*

Bowland (Clitheroe).—22nd April. R.D.C. Electrically operated duplicate pumping plant for West Bradford sewerage. Arnold Brooksbank, consulting engineer, 48, Sunbridge Road, Bradford.

India.—22nd June. Superintending Engineer, Technical (Electrical), 157, Mount Road, Madras, 2. Indoor and outdoor switchgear and power transformers for substations proposed under Periyar hydro-electric scheme. (E.S.B. 7504/55. Ten/13281.)*

Kidderminster.—6th May. Borough Council. Street lighting equipment. (See this issue.)

Kuwait.—31st May. Government Department of Electricity. 11 kV distribution system. (See this issue.)

New Zealand.—3rd May. Auckland Harbour Board. 230 V harbour radar equipment. (E.S.B. 7114/55. Ten/13234.)*

12th July. State Hydro-Electric Department. One 30,000 kVA, 110/33 kV transformer bank and spare unit. (E.S.B. 7147/55. Ten/13237.)*

Nottingham—9th May. City Water Department. Two centrifugal booster pumps and electric motors for Bestwood Park pumping station. B. W. Davies, engineer and general manager, Water Department, Castle Boulevard.

Portuguese East Africa.—28th April. Procurement Purchasing Commission, Lourenco Marques. Five electricity generators for the Zambezi District Administration. (E.S.B. 7393/55. Ten/13251.)*

6th May. Inspector General of Development, Portuguese Ministry of Overseas Territories. Incomati-Movene dam (hydro-electric) scheme, Mozambique, including hydro-electric subterranean power station, etc. (E.S.B. 7220/55. Ten/13265.)*

South Africa.—22nd April. Corporation of the City of Durban, Electricity Department. Vulcanized india rubber insulated wire. (E.S.B. 7482/55. Ten/13286.)* 6th May. 200-220 V watthour meters. (E.S.B. 7481/55. Ten/13287.)*

4th May. Stores Department, South African Railways. 66 V insulated cable. (E.S.B. 7552/55. Ten/13285)* and (E.S.B. 7553/55. Ten/13289.)* Intercommunication system. (E.S.B. 7441/55. Ten/13276.)*

Tangier.—31st May. Ingenieur Directeur de la Regie des Services d l'Eau et de l'Electricité. H.v. overhead line, 5,500 V transformer station, l.v. overhead system, etc. (E.S.B. 7402/55. Ten/13268.)*

United States.—28th April. Bureau of Reclamation, Colorado. Air switches, etc. (E.S.B. 7316/55. Ten/13275.)* 3rd May. One 15,000 kVA power transformer. (E.S.B. 7049/55. Ten/13264.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Wolverhampton.—13th May. Borough Corporation. Street lighting equipment. (See this issue.)

ORDERS PLACED

Bedford.—Corporation Highways and Sewerage Committee. Recommended. Street lighting equipment for Kimbolton Road and Cardington Road (£3,407).—Metropolitan-Vickers Electrical Co.

Burnley.—Corporation Housing Committee. Electrical work in 57 houses on the Far Brunshaw estate (£1,560).—Williams Bros., Wolverhampton.

Totnes. — Corporation. Recommended. First part of scheme for modernization of street lighting, comprising Bridgetown Hill, Fore Street, High Street, Follaton, Coronation Road and Ashburton Road (£4,260).—British Thomson-Houston Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amesbury. — Extensions to secondary modern school (£87,500); F. I. Bowden, county architect, County Hall, Trowbridge.

Andover. — Extensions to Guildhall (£27,000); R. S. Offord, borough surveyor, Beech Hurst, Weyhill Road.

Ashton-under-Lyne.—Police headquarters in Jowetts Walk (£157,000), for Lancs C.C.; G. Noel Hill, county architect, County Offices, Fishergate Hill, Preston.

Banstead.—Dwellings (140), Shawley Way and Nork Way; U.D.C. surveyor.

Barnard Castle.—Houses (28), at Evenwood; J. Lawton, R.D.C. architect, 45, Galgate.

Basildon.—Development of town centre to provide shops, offices, public buildings, theatre, cinema, municipal offices, police station, court house, etc.; general manager, Development Corporation, Gifford House, London Road, Bowes Gifford, Essex.

Berwick.—Factory on Tweedside trading estate; Robert Pringle & Sons, Ltd., Hosiery Works, Hawick.

Boldon.—Houses (90) and bungalows (12); U.D.C. surveyor, East Boldon.

Bournemouth.—Showrooms and offices; Willis (Bournemouth), Ltd., Old St. John's Buildings, Winton.

Bridlington.—Bungalows (190) at Graingers Camp for Marshalls Caterers (Bridlington), Ltd.; J. Houghton, architect, 147, Fairfax Road, Hull.

Bristol.—Multi-storey car park and shops in Fairfax Street; J. B. Bennett, city engineer, 470, Bath Road.

Cambridge.—Houses (100), in two contracts, on the Arbury Road estate; city surveyor, Guildhall.

Cheltenham. — Factory in Tewkesbury Road; T. W. Bayston, Ltd., electro-platers, 31, St. Paul's Street North.

Chesterfield.—Rebuilding works and erection of new offices; Watertight Fittings, Ltd., Victory Works.

Chester-le-Street.—Side wards and clinical room, General Hospital; Newcastle-on-Tyne Regional Hospital Board, Osborne Road, Newcastle.

Cumberland.—Hostel for old people at Maryport; J. H. Haughan, county architect, 15, Portland Square, Carlisle.

Dagenham.—Factory on the Hainault estate; Tubela Engineering Co., Ltd., tube bending machine manufacturers, 6, Furze Street, London, E.3.

Daventry.—Houses (76); borough engineer.

Derby.—New ward block for Manor Hospital; Naylor, Sale & Widdows, architects, St. Mary's Gate Chambers.

Dewsbury.—Additional operating theatre for Staincliffe General Hospital; Leeds Regional Hospital Board, Park Parade, Harrogate.

Durham. — Proposed observatory and history department for the University; C. Elgey, architect, 7a, North Bailey, Durham.

Ealing.—Houses (42), Hilltop estate; Haymills Houses, Ltd., Hanger Lane, London, W.5.

Edinburgh.—Houses (42), Oxgangs Place area (£53,000), for City Council; city engineer, 329, High Street.

Eston.—Civic buildings; C. Harrison, U.D.C. surveyor, Grangetown, South Bank.

Exeter.—Maisonnettes (524), Whipton Lane site; John Brierley, city surveyor, 7, Southernhay West.

Hemel Hempstead.—Departmental store, Westbrook Hey; F. W. Woolworth & Co., Ltd., 311, Oxford Street, London, W.1.

Hexham.—Houses (60); U.D.C. surveyor.

High Wycombe.—Houses (142), Hatters Farm estate; borough surveyor.

Hove.—Extensions to premises at Portslade (£100,000); Kayser Bondor, Ltd., 24, Albemarle Street, London, W.1.

Ipswich.—Shops and offices; Porte & Partners, architects, 16, Devonshire Square, London, E.C.2.

Isle of Ely.—Secondary modern schools at Downham Road, Ely, and Witchford, additional hall at Hereward School, March (£17,500), classrooms, etc., at Cromwell School, Chatteris (£21,250) and school clinic, Oakwood House, March (£9,673); county architect, March, Cambs.

Kingston-on-Thames.—Retail store proposed (£100,000); C & A Modes, Ltd., Head Office, North Row, London, W.1.

Kington (Herefordshire).—Houses (60), Hergest; U.D.C. surveyor, Council Offices, 2, High Street.

Leeds.—Buildings for technological departments at the University; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Leicester.—Houses (70), Beaumont Leys estate; city architect.

London.—Shops and offices, Pentonville Road, Islington; E. A. Stone, Toms & Partners, architects, 28, South Audley Street, W.1.

Factory, Westmoreland Road, Kingsbury; John Laing & Son, Ltd., Bunns Lane, N.W.7.

Rebuilding Royal Mint, Tower Hill (£925,000), for Ministry of Works; architects' department, Abell House, John Islip Street, S.W.1.

Manchester.—Development of civic centre at Wythenshawe, for City Council; city surveyor, Town Hall, 2.

Melton Mowbray.—Houses (117), on the Dorothy Avenue site; W. H. Jarvis, U.D.C. surveyor, Egerton Lodge.

Middlesbrough.—Maternity and child welfare clinic, Park End; borough engineer.

Newcastle-on-Tyne.—Factory in Helmsley Road; E. Jackson, 26, Tyne Street, Lemington-on-Tyne.

Further stage of a college of technology (£368,000); city architect.

Peterborough. — Houses (60), Poplar Avenue and two-storey maisonnettes or flats on Lime House site, Paston; city architect, Bridge Street.

Police headquarters, Bridge Street (£55,000); L. H. Robjohn, Town Hall.

Prescot.—Shops and offices and flats, Bryer Road; Gornall, Kelly & Partners, architects, 155, The Albany, Old Hall Street, Liverpool.

Prudhoe.—Houses (198), at West Wylam, for U.D.C.; T. Philipson, clerk, 18, South Road.

Rawmarsh.—Houses (200), Monkswood No. 2 estate; J. R. S. Creighton, U.D.C. surveyor, Parkgate.

Reading.—Factory on Manor Farm estate; Peter Shepherd & Co., Head Office, Kennetside.

Romford.—Flats (54), at Prospect Place development, and (42) on sites at Cross Road; J. Twinn, town clerk.

Saltburn (Yorks).—Conversion of Saltburn baths hall into dance hall and conference building for the U.D.C. (£10,700); R. Stroughair, surveyor.

Scarborough.—Bakery, Gladstone Street for D. Wray and Sons, wholesale bakers; G. W. Alderson, 4, Pavilion Terrace.

Sleaford.—Houses (33), on Gypsy Lane estate; J. W. Harris, U.D.C. surveyor, 25, Westgate.

Southampton.—Dwellings (625), on Thornhill estate, Section 1; borough surveyor.

Showrooms, offices and workshops at Bernard Street and Canal Walk; W. & T. Avery, Ltd., scale makers, 168, Northam Road.

South Shields.—Factory in Maxwell Street; Elsy and Gibbons, Ltd., plumbers, etc., Havelock Street.

Spenborough.—Transport garage at Brookhouse Mills, Cleckheaton; U.D.C. surveyor, Church Street, Cleckheaton.

Spennymoor.—Market and bus station; U.D.C. surveyor.

Stanground.—Assembly hall at secondary school, and alterations to electric lighting, etc. (£16,300); county architect, Huntingdon.

Stockton-on-Tees.—Houses (68), and flats (48), on the Newtown site for the T.C.; borough architect, 28, The Square.

Sunderland.—Slum clearance area, Lawrence Street and erection of block of maisonnettes and terraced houses; borough architect.

Surbiton.—R.C. church, Ewell Road; Wilfrid C. Mangan, architect, 2, Ribblesdale Place, Preston.

Tutbury.—Houses (62), on Church Road estate, Stretton; D. H. Jackson, R.D.C. surveyor, Kingsley, Rolleston Road, Burton-on-Trent.

Twickenham.—Fire station on the South Road corner site (£44,175), for the C.C.; Middlesex county architect, 10, Great George Street, London, S.W.1.

Wallsend.—Three-storey flats (£57,442), houses (32) (£43,670), and flats (8) (£8,278); borough surveyor.

St. John's Church; G. E. Charlewood, architect, 14, Neville Street, Newcastle-on-Tyne.

Wembley.—Works extensions; Thermo Engineers, Ltd., Abbey Works, Mount Pleasant, Alperton.

Factory and offices; Clearex Products, Ltd., Heather Park Drive, Stonebridge Park.

West Hartlepool.—Two blocks of flatlets for old people, for the T.C. (£15,500); A. G. Sinclair, borough architect.

Whitehaven.—Extensions to factory for The Vale Carpet Co., Ltd.; R. Ward & Partners, architects, 29, Chesham Place, Belgrave Square, London, S.W.1.

Willesden.—Secondary modern school in Crest Road, Neasden (£390,000), for County E.C.; Middlesex county architect, 10, Great George Street, London, S.W.1.

Winchester. — Slaughterhouse, Winnall Road; city surveyor.

Workington.—Maternity unit for Infirmary; Simpson, Oldfield & Saul, architects, N.P. Bank Chambers.

Canadian Electrical Manufacture

CANADIAN electrical manufacture continues to expand. According to returns just issued in Ottawa by the Dominion Bureau of Statistics, factory shipments reported by firms in the Canadian electrical apparatus and supplies industry in 1953 were valued at $848 million, an increase of 18½ per cent on the 1952 total. This increase followed one of approximately 45 per cent between 1951 and 1952. To the 1953 total should be added $128 million (against $119 million in 1952) representing the value of production of firms not classified within the group because they are primarily engaged in other lines of manufacture.

Comparative values for the two years are given in the accompanying table. Among outstanding increases may be mentioned those in power plant, household appliances, meters and instruments, and lamps, including fluorescent. At the same time the radio, television and electronic branches continued to progress; for example, the value of T.V. sets made was $81 million against $30 million in 1952 and $13 million in 1951. The output of wires and cables expanded and they represent about one-seventh of the total of all products; prominent among them was the paper insulated telephone type.

Of the total value of generators, above nine-tenths were a.c. 1,001 kVA and above, while of motors by far the biggest item was single phase induction machines of ½ h.p. and under. It should be noted that the figures given in the published returns for refrigeration equipment include all types; electrical refrigerators are not recorded separately.

Class of Goods	Selling Value at Works 1952 $(000)	1953 $(000)
Convertor equipment	2,325	3,315
Industrial control apparatus	13,546	12,351
Generators and parts	17,718	20,590
Motors and parts	33,976	41,427
Switchgear and protective equipment	41,521	40,852
Transformers and parts	57,738	59,143
Welding apparatus	5,796	6,545
Stoves, rangettes and cooking plates	11,858	15,097
Heating elements for stoves, etc.	2,253	3,236
Air heaters, electric, portable	533	1,407
Heating pads, electric	436	461
Water heaters, electric	1,134	1,244
Flat irons, electric	2,574	3,894
Toasters, electric	1,252	2,522
Unspecified cooking and heating apparatus	2,771	3,610
Food mixers, electric	1,683	2,241
Vacuum cleaners and parts	8,585	7,906
Fans, portable	517	1,192
Fans, other	478	321
Unspecified motor-driven appliances including washing machines, air conditioners, etc.	12,553	15,069
Refrigeration equipment	51,206	58,386
Batteries, storage	21,233	19,897
Batteries, dry cell	8,627	7,770
Parts and supplies for batteries, and wet cell type batteries	2,144	1,993
Conduit and fittings	7,579	9,138
Cut-outs and fuses	3,689	2,945
Electro-therapeutic apparatus	763	706
Electrical industrial furnaces	645	348
Electrical industrial ovens and other heating equipment	1,521	1,111
Watt-hour meters	6,190	6,936
Electrical indicating instruments	799	978
Other electrical instruments and meters	1,355	1,457
Parts for instruments and meters	1,012	980
Lamps (bulbs), incandescent	13,999	16,444
Lamps (bulbs), fluorescent	2,817	3,599
Lighting fixtures	20,625	22,818
Line material	7,181	5,726
Radio receiving sets, civilian	22,179	27,622
Record players, electrical	1,718	1,571
Radio transmission equipment, civilian	5,293	6,285
Radio equipment, military	16,401	20,746
Radar equipment	26,504	31,442
Radio condensers	2,507	4,271
Television sets	30,073	81,305
Television equipment, other	634	1,527
Other radio and electronic equipment, except tubes and transformers	9,256	14,589
Traffic signal systems	410	314
Fire alarm signals	565	637
Interior signal and clock systems excluding telephone	867	1,003
Vacuum tubes	7,131	14,012
Wiring devices	12,698	14,672
Wires and cables	111,819	117,578
Telephone materials, including switchboards, telephones, transmitters, etc.	40,229	43,352

Electrostatic Paint Spraying

A charge of 90,000 V is employed in the latest electrostatic paint spray installation at the Cowley assembly plant of Morris Motors, Ltd. It is claimed to cut paint wastage to less than 2 per cent compared with the 50 per cent lost by the ordinary spray gun.

The principle of operation is a simple one: the paint is pumped to a set of hemispherical heads—the atomizers—which are rotated at 900 r.p.m. and charged to 90,000 V. Centrifugal force moves the paint to the outer edge of the hemispheres, from where it is flung through an electrostatic field on to the article to be painted, which constitutes the nearest earth. There are three of these heads on each side, and the work passes on a conveyor between them, allowing both surfaces to be treated. In effect, the article passes through a curtain of paint particles, so small that they are invisible until settled on the metal work, giving the impression that a coat of paint materializes from nowhere.

Apart from the tremendous saving in materials, this plant does away with the need for operators to wear gauze masks. Only one man is needed to supervise it, and it cuts out the strain and tiredness resulting from the use of a manual spray gun. The plant was invented by an American, Harold Ransburg, and was fitted at Cowley by a London firm, Henry W. Peabody (Industrial), Ltd., which makes these machines under licence.

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